THE RECLAMATION ERA

VOL. 27, NO. 1 JANUARY 1937

ALL-AMERICAN CANAL, CALIFORNIA-ARIZONA
LOOKING DOWNSTREAM

Additional National Reclamation Association High Lights

M. L. Wilson, Assistant Secretary of Agriculture, in an address on "The Future of American Agriculture", made the following pertinent remarks at the recent annual meeting in Spokane of the National Reclamation Association:

"I take it that your organization is based on the absolute need (if this part of the country is to realize its potentialities) of efficient use of the water resources of our Western States. No part of our agricultural structure has to take greater account of the future than reclamation. If a reclamation project is to succeed, we must forecast future needs and gauge our resources as accurately as possible.

"Planning, of course, is an essential part of a democracy and is not new to this country. We have suddenly become more conscious of the need for planning because of recent extreme economic and social dislocations. Our agricultural plans cannot be drawn up as blue prints because they may merely indicate broad channels and general directions; they must be sensitive to, and be molded by the forces which play upon our civilization; and they must grow and develop as the Nation grows and develops.

"We can look upon reclamation in the Western States, not as a land speculative and land booster program, but as a part of agricultural adjustment and land use which will give greater stability and which as a whole will bring about a better relationship with regard to the use of all the land. When viewed from this angle irrigation is a part of a real land use and adjustment program."

The address by Senator William E. Borah of Idaho at the banquet, broadcast over the National Broadcasting Co., was an outstanding feature of the convention. He pledged full support of the reclamation program, including works designed to furnish supplemental water to lands now in projects needing additional storage, and emphasized that present work and planning should look far into the future, as a part of building the Nation into an economic unit, and called attention to farmers from drought-stricken areas as good and desirable people.

Senator James P. Pope of Idaho, in an interview, said he felt that the Nation as a whole had become more reclamation-minded, and pledged his support for such meritorious projects as Grand Coulee and Roza.

Senator Lewis B. Schwellenbach of Washington, speaker at the joint luncheon with the Spokane Chamber of Commerce, called attention to the changing attitude of the Central States and the East in favor of reclamation in the West, due largely to the 2 recent drought years and that in the irrigated West there are practically no water supply uncertainties. He stated that operations of the Tennessee Valley Authority are eliminating fear by power interests of the auxiliary power developments on reclamation projects, and promised that the fight for due recognition of reclamation by Congress would be continued.

Senator H. H. Schwartz, Casper, Wyo., and Representative Compton I. White, of Idaho, promised staunch support of the Association program, including early completion of projects now under construction.

THE
RECLAMATION ERA

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Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 27, No. 1

JANUARY 1937

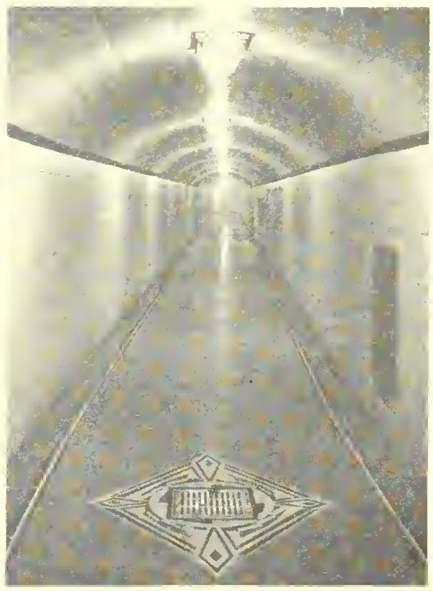
Boulder Dam Elevators

By Rupert B. Spearman, Assistant Engineer

ONE generally thinks of the common use of the modern automatic electric elevator as furnishing transportation to the upper floors of tall buildings, but such is not the case of the two elevators in Boulder Dam, which are unique in the fact that they furnish transportation to levels below the starting point.

Imagine stepping out of your car, parked on top of the highest dam in the world, spending a few moments seeing the view above and below the dam, and then stepping through the beautiful marble-walled lobby of the elevator towers, rising 32 feet 6 inches above the top of the dam, into an elevator cage to be dropped down a shaft in the dam a breathtaking distance of 528 feet in 1 minute and 3 seconds, and alighting in a tile-lined, terrazzo-floored gallery. From here you would be escorted by a courteous guide out through this gallery on to one of the visitor's balconies at the upstream end of each of the main generating rooms in the wings of the world's largest power plant, where the inner workings of the plant are explained to you by your guide.

This is exactly what the more than 700 persons who visit the project are doing each day. It is very possible that one of the elevators in Boulder Dam now holds a record for one elevator transportation the same distance, after having carried 3,741 persons down and back in a 15-hour period. There are many who hesitate to make this trip, but if you were to ask some person who had ridden the elevator, whether it seemed fast, he would reply that he hardly noticed he was moving, except for the popping of his ears as he changed elevations so quickly. Although the most popular use of the elevators is the transportation of visitors, one of their main purposes is to carry men to and from work in the power plant.



In addition to the landings at the top of the dam at elevation 1,232.83, and the lowest landing at the gallery leading into the powerhouse at elevation 704.6, there are four intermediate landings at elevations 780, 875, 975, and 1,220.33, which give access into the inspection galleries at these elevations.

For a comparison of the distance the elevators in the dam travel, the elevators in the Washington Monument carry persons up through the Monument a distance of 500 feet, 50 feet less than its height.

ELEVATOR CAPACITY

Each of the two Boulder Dam elevators is designed to lift a load of 5,000 pounds in addition to the weight of the car and cables and, with this load, to travel at a speed of 500 feet per minute. Each car enclosure, constructed of aluminum, has a planned dimension of about 6 by 8 feet and will hold approximately 25 persons of average size. They operate automatically, and when any number of car or call buttons are pressed, each registers a call and the car will go to and stop at all of the floors for which calls are registered, regardless of when the calls are registered and without the necessity of repressing any of the buttons.

For transportation to the various floors in the central section of the powerhouse, an elevator of 4,000 pounds capacity, 22 persons, in addition to the weight of the car and cables, and with a speed of 450 feet per minute, has been installed in each end of the central section. Each of these 2 elevators covers a distance of 117.5 feet from the pipe gallery at elevation 625.5 to the main control room at elevation 743. They are intermediate landings for the pipe shop and turbine gallery at elevation 643.0, the main generator floor at elevation 673.0, the operator's balcony extending the full length of each wing at elevation 683.26, the visitors' balcony in the upstream end of each wing at elevation 705.00, and floors at elevations 717.67 and 730.33 in the central section.

Two elevators have been installed in shafts located in the canyon walls and leading from the adits to the downstream plug outlets to the Nevada and Arizona valve houses, built on opposite canyon walls. These two elevators, one on each side of the canyon, cover a distance of 162 feet from the landing in the adit at elevation 673, to the operating floor in the valve house at elevation 835.0 with one intermediate landing at the main floor at elevation 809.0. The intermediate landing also gives access to the construction adit leading into the upper Nevada penstock header tunnels. Each of these elevators has a capacity of 4,000 pounds and travels at a speed of 300 feet per minute.

The elevators in the dam and in the powerhouse were furnished and installed by the Otis Elevator Co. and the two to the valve houses, by the Haughton Elevator & Machine Co.

Imperial Irrigators Grateful for Boulder Dam

IMPERIAL VALLEY, once threatened with flood and drought each year, now has a water supply which is among the most reliable in the world, M. J. Dowd, chief engineer of the Imperial irrigation district, reports, in congratulating the people of his region upon completion of Boulder Dam.

In Mr. Dowd's report, published recently in the San Diego (Calif.) Union, he said:

"In 1936, farmers of Imperial Valley have had further reason to be thankful for construction of Boulder Dam. No one has yet forgotten the great loss of crops caused by the severe water shortage of 1934, the year before storage was started at Boulder Dam, and while the flow of the river has been considerably higher this year than in 1934, without a supply available behind the dam at this time, Imperial Valley would be short at least several thousand second-feet.

"Last spring, because of the much greater than normal snowpack in the Rocky Mountains, it appeared as though the total discharge of the Colorado River this year would be above normal, which is about 16,000,000 acre-feet; in fact, Government engineers estimated a run-off of more than 17,000,000 acre-feet, and it was expected the peak of the flood in June would exceed 100,000 second-feet.

"The flow has not come up to expectations. The peak of the flood at Grand Canyon occurred May 24 and amounted to about 75,000 second-feet. Usually, the peak comes in June, but this year the maximum flow in June did not reach that quantity. Total discharge of the Colorado River at Grand Canyon for the year, including September, equaled 11,350,000 acre-feet, which, although somewhat larger than for the same period last year, was not up to normal and considerably less than had been estimated. It appears that the total flow for the entire year will not exceed 13,000,000 acre-feet, or about 4,000,000 acre-feet less than anticipated.

RISE IN LAKE MEAD RAPID

"During the flood season this year the height of water in Lake Mead behind Boulder Dam rose very rapidly from an elevation of 905 feet in the middle of April to 984 feet by the end of May, and 1,015 feet by the end of June. As the elevation of the river below the completed dam was 645 feet, this means the depth of water at the end of June in the reservoir was 370 feet at the dam, amounting to a total of 9,000,000 acre-feet in storage, which is the equivalent of nearly 3 years' use in Imperial Valley.

"During July, the water elevation behind the dam rose slowly a distance of about 5 feet. By the end of July the inflow into the reservoir about equaled the outflow, the water level increasing very slowly, thereafter during August and most of September, reaching on September 10 a maximum elevation for the year, with a height of 1,026 feet, representing a storage of about 9,600,000 acre-feet. Since September 15 the height of the water has receded and on October 1 was 1,024.5 feet, representing a storage of about 9,500,000 acre-feet, and it is expected that this will continue gradually to decrease until the spring run-off next year.

"With such a large amount of water in storage, the farmers of Imperial Valley no longer have any concern with the flow of the river above Boulder Dam, as they are amply protected for all of their needs for a period of several years, even though there should be no inflow whatsoever into the reservoir.

"In a recent 2 weeks' period the inflow into the reservoir was about 4,500 second-feet, while the amount released below the dam for irrigation was about 7,500 second-feet. In other words, the water in storage behind the dam was drawn on to the extent of 3,000 second-feet a day. It is not necessary to point out the tremendous value of the storage water which was used during this period, when the demand for water in Imperial Valley has been heavier than for any other similar period of record.

"Few places in the world today have the assurance of an adequate supply of water compared with that of Imperial Valley, and this assurance is not for just 1 or 2 years, but for as long as irrigation will continue in the valley. Thus Boulder Dam has taken care of two of the major problems of Imperial Valley, one being the menace of floods and the other the menace of water shortage, such as have been experienced in former years."

Federal Irrigation Congress[1] Adopts Resolutions

RESOLUTION 1:

WHEREAS the best interests of the settlers on existing projects, the orderly operation of the Bureau of Reclamation, and the whole program of reclamation in the West hinges upon the adoption of a program of repayment of construction charges that is based upon the ability of project water users to make construction repayment under both prosperous and depressed economic conditions; and

WHEREAS it is desirable to avoid the necessity for further moratorium; now, therefore, be it

Resolved, That the Congress of the United States be urged to pass and that our congressional delegates and the Bureau of Reclamation be requested to use their best efforts to secure the passage of legislation providing for repayment of charges based upon the ability of the settlers to pay from the net earnings of their lands; that a sufficient appropriation be made to make an investigation on all projects as provided for in the Borah-Hatch bill approved April 14, 1936, by the Seventy-fourth Congress; and that payment of construction charges be suspended until such legislation can be passed and put into operation.

RESOLUTION 2:

WHEREAS after years of use of their irrigation, storage, and drainage systems many projects now find that additional storage, lining of canals, drainage of seeped lands, and other project betterments are necessary for the completion and successful operation of those projects; now, therefore, be it

Resolved, That this Federal Irrigation Congress urge the Bureau of Reclamation to adopt as a policy that such betterments on existing projects shall go hand in hand with construction work on new projects, and that Congress be asked for additional funds for the completion of such betterments in order that a steady, balanced agriculture may be maintained on all existing projects.

RESOLUTION 3:

WHEREAS the legal title to water rights of water users on reclamation projects is being attacked and suits instituted inimical to the rights of project settlers; now, therefore, be it

Resolved, That the Bureau of Reclamation be requested to protect the water rights of such projects to the fullest extent.

[1] Sixth annual meeting held in Provo, Utah.

RESOLUTION 4:

WHEREAS the Secretary of the Interior has the power to change the classification of lands on projects having classified lands from the nonpaying class to the paying class and does not have the power to change the classification of lands from the paying class to the nonpaying class; now, therefore, be it

Resolved, That Congress be asked to pass such legislation as shall be necessary to authorize the Secretary of the Interior to reduce classifications of lands in paying classes to nonpaying class basis.

RESOLUTIONS 5:

WHEREAS, this has been both a pleasant and profitable meeting; NOW, THEREFORE, be it *Resolved*, that we extend to President Grebe, Mayor Mark Anderson of Provo, the directors of the Strawberry Water Users Association, and all others who have contributed to our program and entertainment, our appreciation of their efforts in our behalf.

NATIONAL RECLAMATION ASSOCIATION DELEGATES

President Grebe announced that N. B. Phillips and A. N. Mathers, both being delegates to the Federal Irrigation Congress Convention as well as members of the board of directors of the National Reclamation Association, had been appointed by the National Reclamation Association to represent that organization at the proceedings in Provo, Utah, and to propose cooperation between the two organizations on all problems of common interest.

In response to this friendly attitude the following resolution was unanimously adopted:

> The National Reclamation Association and the Federal Irrigation Congress both are composed of individuals interested in the feasible reclamation of the western portion of the United States. As a result of this mutuality of interest there is bound to be a common ground upon which both organizations can stand shoulder to shoulder and work for those things which are most beneficial for Federal reclamation as a national program. In establishing interests in common it is believed only wise and prudent that existing developments be given due consideraation and dove tailed into the program of pending and proposed construction; now be it
>
> *Resolved*, That the Federal Irrigation Congress extend thanks and appreciation for the cordial and friendly spirit extended by N. B. Phillips and A. N. Mathers in behalf of the board of directors of the National Reclamation Association; be it further
>
> *Resolved*, That the Federal Irrigation Congress completely and sincerely reciprocate in this friendly attitude and pledge its support and cooperation in all matters of common interest.

BUREAU OF RECLAMATION RESOLUTION

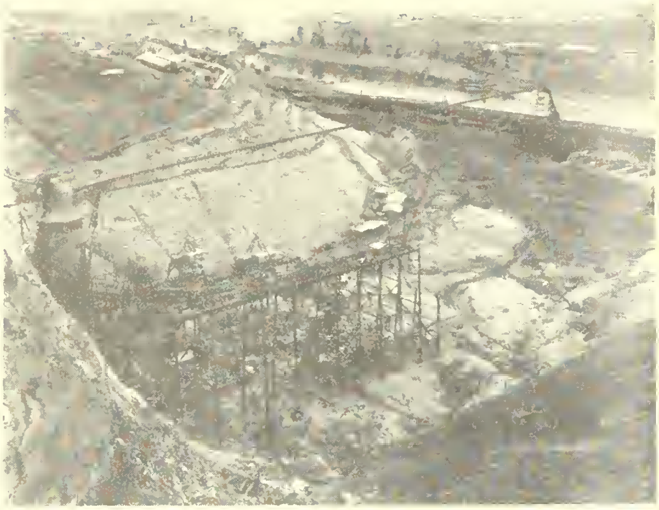
The following resolution was presented, seconded and unanimously adopted:

> The Federal Irrigation Congress is unqualifiedly favoring and sponsoring the economic development of the western United States and recognizes the importance of sound reclamation activity in this program of growth. This organization is mindful of the vital role played by the Bureau of Reclamation in the past and fully senses the importance of the future task of not only extending the development of irrigation agriculture but also adapting existing systems to the tempo of normal social and economic possibilities. This future outlook is vast in its proportions and from mutual confidence and cooperation will come the greatest realization of mutual needs and aims; therefore, be it
>
> *Resolved*, That the Federal Irrigation Congress expresses its complete confidence in Acting Commissioner of Reclamation, John C. Page, and also voices a sincere desire to fully cooperate with the Bureau in a well-balanced reclamation program.

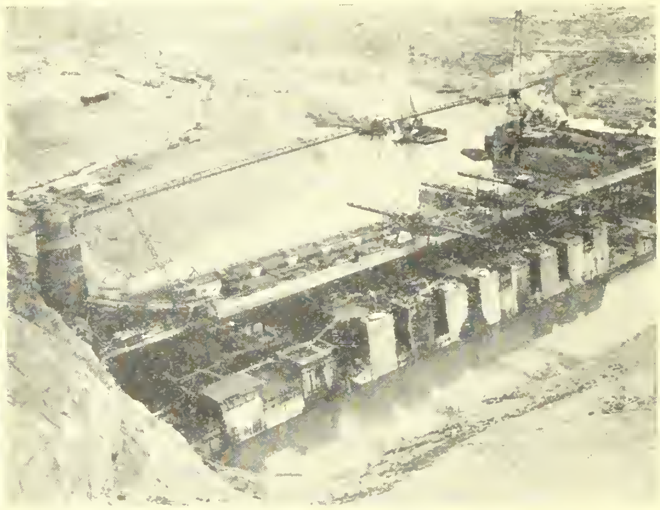
New Settlers for Orland

The Resettlement Administration has purchased several large holdings on the Orland project, California, and is planning on placing about 20 families from the drought-stricken areas on project lands. The lands acquired are all undeveloped properties and in most cases were far behind in the payment of project charges.

The change in ownership will result in restoring these lands to the county tax rolls, and will also insure the resumption of payments to the Bureau. Several of the new settlers have arrived and appear to be of an unusually good type.



WEST EXCAVATION DECEMBER 6, 1935.



WEST ABUTMENT DECEMBER 6, 1936.

A Block of 1,725,000 Cubic Yards of Concrete Poured

In West Abutment of Grand Coulee Dam December 6, 1935, to December 6, 1936

ON DECEMBER 6, 1935, Gov. C. D. Martin of Washington tripped a 4-cubic-yard bucket pouring the first concrete in Grand Coulee Dam. One year later on December 6, 1936, a workman in the general course of a busy day tripped a bucket bringing to 1,725,000 cubic yards the total of concrete placed in the growing dam during the first year.

The first concrete was poured before all the bedrock had been laid bare in the west excavation. In a year this section of the dam was above the water surface of the river, and diversion of the stream through four slots left in the massive structure was under way.

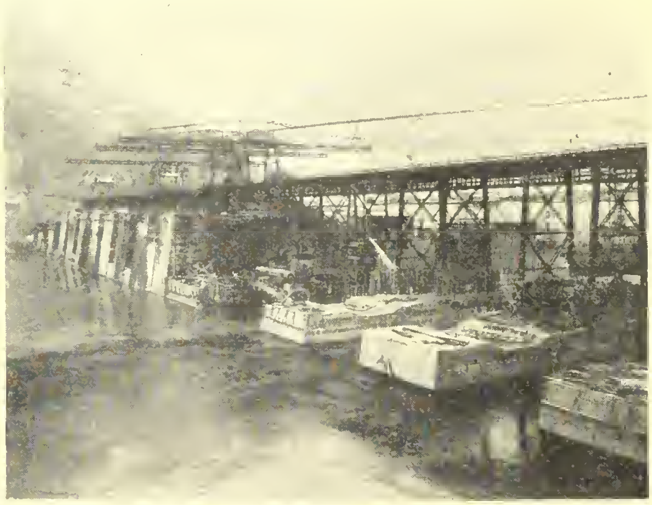
Good progress has been made during this year all along the line. The pouring of concrete is now under way in the east excavation as well. An average of nearly 6,000 men has been employed throughout the year by the Bureau of Reclamation and the contractor, the M. W. A. K. Co., on the work.

The excavation which remains is that for the central section of the dam through which the Columbia River flowed. By March it is expected that the river will have been driven completely from its bed. Two midriver cofferdams are now under construction. When they have been completed the central section will be unwatered for construction of the last division of the dam.

Two steel trestles were constructed in the west excavation for use in placing the concrete. As the interlocking concrete piers of the abutment grew, they were extended to the west cofferdam. The steel of the trestles was embedded in the rising concrete. The lower trestle shown partially completed in the picture at the lower left, now has been covered. The view at the lower right shows the concrete almost reaching the top of the high trestle at the western end of the abutment.

The concrete in the west abutment is being mixed at the mixing plant on the western side of the river. The east mix plant, which will prepare the concrete for the eastern abutment, is now going into high-speed production.

BEDROCK EXPOSED DECEMBER 6, 1935.



DIVERSION UNDERWAY DECEMBER 6, 1936.

ALTHOUGH the operations at Moon Lake Dam were suspended during November, unemployment conditions are at a minimum by reason of small construction projects and oiling and improvement programs on the State highway in the vicinity of the project.

The Worth of the Boulder Canyon Project

UNCLE SAM has spent $165,000,000 on the Boulder Canyon project. The purchase order issued by Congress stipulated that this money should buy a dam, a power plant, a canal, and include the interest on the investment during construction. But Uncle Sam—meaning you and me—has gotten more for his money; the sum has bought something else no visitor can see, a vast amount of fundamental knowledge about dams, equipment, and canals that will result in lower cost and better construction on future jobs.

In building Boulder the limits of construction in nearly every direction were extended, not by just the modest increases that we have come to expect, but by great advances along the whole front in engineering construction. Structures and machines were made several times bigger, or stronger, or of greater capacity, or more compact, or simpler to operate. The builders of the dam, works, and the machinery in nearly every case had to go first to the laboratory to make tests, to experiment in order to determine if previous methods would be successful when applied to the new order of sizes. Many new formulas were determined, new principles discovered.

No single page could even list these researches. A new concrete mix was developed as a result of 94 different cement tests on 15,000 specimens. Formulas for bolted flange design were found inadequate for such large turbine scroll-case sections; laboratory tests on models have thrown new light on flange design. New steels were necessary to permit of larger casting. Transformer engineers got over the transportation hurdle that stands in the way of increased capacity by developing a tank of new shape without loss of strength. Tests of transmission conductors larger than ever before used, made in wind tunnels and on full-size lines in the field, brought a fund of information on conductor vibration and resulted in improved clamping mechanism.

IMPROVED MACHINERY AT LESS COST

These studies will undoubtedly be reflected in improvements and lower costs of future building. E. F. Scattergood, chief electrical engineer and general manager of the bureau of power and light, city of Los Angeles, has stated: "This and other pioneering work has made possible the provision of generating units, transmission lines, and receiving station equipment at a total cost of $30,000,000; while the investment cost using the best standard machinery, transmission equipment and construction practice previously in use would approximate $42,000,000 and would afford less flexibility and reliability."

Not alone have the civil, mechanical, and electrical engineers enhanced their knowledge by their experiences at Boulder. Geophysicists, for example, will have the opportunity to check their theories of isostasy, that the earth's crust floats upon a heavier lower material in a plastic state. Lake Mead will weigh 41,500,000,000 tons, which is a lot of weight to concentrate on one small area of the earth's surface. Benchmarks have been carefully placed by the Coast and Geodetic Survey and will be checked periodically. Such information may lead to better understanding of earthquakes and structural geology.

Boulder will increase our material wealth. The generation of power, the produce from the rich valleys irrigated from it, the water supply for thirsty cities will more than repay all the cost. The increase in our knowledge of materials, of machines, and of the earth itself is clear gain.—*The Electric Journal, November 1936.*

HOME IN 1914 AND 1936 OF A CONTENTED SETTLER AT OLATHE, COLO., WHERE A HUSBAND AND WIFE HAVE FOUND IN ITS ESTABLISHMENT A LIFETIME JOB.

The Reclamation Era

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Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

JANUARY 1937

What Happened at Spokane

The December issue of the ERA featured the program for the annual meeting of the National Reclamation Association. Advance copies of some addresses were received in time to be included in that issue and those which arrived too late will be printed in whole or in part in succeeding issues. Advice of action at the meeting came too late for inclusion in the December issue.

A well attended serious-minded meeting of reclamation enthusiasts was held at Spokane, November 23 and 24. Realizing the importance of a united front in securing support for a well-rounded reclamation program, the States sent as delegates men with an intimate knowledge of the effects of the Federal reclamation policy. This is reflected in the committee recommendations and resolutions adopted by the association.

The following are the recommendations of the legislative committee:

The association itself should be made more effective and be continually active with full-time paid personnel such as the board of directors may choose to arrange for. We believe an amount should be raised of not less than $25,000 for annual expenses.

Your committee recommends the reenactment of the Hatch bill to provide for a qualified committee of three appointed by the Secretary of the Interior with an adequate appropriation for a general study and recommendation to Congress relative to repayment of construction costs and other general reclamation policies.

The development of power as a subsidiary in reclamation, flood control, and navigation is of vital interest; we recommend that a proper and full allocation of the costs of power produced in excess of the amount required for operation of the irrigation projects from and in connection with any reclamation dam or reservoir be assumed as a charge against power earnings so that the construction charge against the farm land may be to that extent and thereby reduced.

That the power produced from an irrigation dam should be sold at an equitable profit to farm and city consumers and/or distributors, or other agencies with the objective that the water users may receive their share of the benefit from their own investment and property by reduction in cost of that portion of the development allocated as a proper charge against them.

After the cost of the power development, reservoir, and general irrigation system has been refunded any net remaining over and above operating costs shall be kept in a separate fund to be used in the development of the natural resources within the area not only where the development has taken place, but also in that area which is the source of the developed power.

That repayments from all projects constructed under the Bureau of Reclamation and with emergency funds automatically revert to the Reclamation Revolving Fund.

The arid lands should be reclaimed, and we believe that when water is made available for such lands the settlement thereof by competent settlers will take care of itself under the rules and regulations of the Reclamation Bureau in effect at the present time.

A large number of water stabilization and flood-control projects have been started by the Bureau of Reclamation, the Army engineers, the Public Works Administration and other agencies and we urge the early completion of such projects.

Recognizing the value of irrigation storage in connection with flood control, navigation, and other purposes, there should be a study as to the respective interests, agencies, and costs, segregating irrigation from other items and making an allocation chargeable in the proper amount to each purpose.

A considerable number of supplemental water supply and water stabilization projects proposed under the Administration of Public Works have been disallowed because the projects were unable for one reason or another to begin construction by December 15, 1935. Where the projects are feasible and practical it is recommended that the administrators of the Emergency Relief Act be requested to lift the ban and that such projects be given the same opportunities to qualify for grants and construction as if disapproval had not been ordered on the original or previous application.

The conservation of water as a natural resource being recognized generally as of prime importance to arid and semiarid regions as well as to the Nation as a whole, it is recommended that the limitations on the man-year cost imposed by the Emergency Relief Administration on proposed water conservation projects be extended or removed to permit the construction of many otherwise economically feasible projects.

Whereas in certain Western States the Federal Government has established reclamation projects for the joint benefit and participation of citizen and Indian population, and

Whereas several of said projects require auxiliary conservation facilities to adequately sustain necessary irrigation requirements; and

Whereas such essential facilities can only be obtained through Federal sponsorship; now therefore be it

(Cut along this line)

COMMISSIONER, (Date) ____________

Bureau of Reclamation,

Washington, D. C.

SIR: I am enclosing my check [1] (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) ____________

(Address) ____________

____

[1] Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Resolved by the National Reclamation Association in convention assembled, That we favor and support reclamation projects commonly beneficial to citizen and Indian population irrespective of the agency sponsoring same.

The committee recommends that the legislative committee and board of directors meet 2 days previous to the annual meeting of the Association for preparation of matters to come before the convention for consideration, and that the Board recommend to the incoming Board and Committee that both groups continue in session during the day following the convention or as long as necessary to arrange for carrying out the mandates of the convention.

These annual meetings of the National Reclamation Association, made up of official delegates from Federal reclamation projects, are not only helpful to the water users on the projects, as they give them official spokesmen, but also the Federal Government is given counsel which is representative of the group whose interests are in the charge of the Federal Bureau of Reclamation.

One of the major results of giving a united front in the cause of Federal reclamation is a better informed public with a complete understanding of what Federal reclamation is doing for the West a reclamation that by helping itself, also indirectly, but in a great measure, helps the East. Ignorance of facts very often creates opposition, and this must be avoided by a program of education which the National Reclamation Association is in a strategic position to adopt.—M. A. SCHNURR.

A 40-acre farm in the Pioneer district of the Minidoka project was sold recently for $5,000 cash, and a farm of 80 acres, also near Pioneer, changed hands at a price of $6,000.

Radio Service Between Taylor Park Dam and Gunnison

Taylor Park Dam is located on Taylor River, a tributary of the Gunnison River about 30 miles northeast of Gunnison, Colo., at an elevation of 9,180 feet above sea level. Telephone communication facilities were necessary between the dam and the project office at Gunnison in order to expedite construction of the dam. The country between Taylor Park Dam and Gunnison is mountainous and is subject to heavy snows in the winter and these conditions made it extremely difficult and expensive to build and operate a telephone line. Consequently, it was decided to use radio communication between these two points. The total cost of the two radio sets completely installed is approximately $1,250, whereas the cost of a telephone line to the dam site was estimated at between $7,000 and $8,000.

The radio sets are of the type developed and used by the United States Forest Service with transmitter and receiver mounted in a compact steel cabinet. The transmitters have an output of 40 watts and the receivers use a superhetrodyne circuit. The antennae consist of 212 feet of no. 14 AWG copper wire with the lead-in connection tapped about 30 feet from the center. The antenna at Gunnison is supported by two 55-foot poles, the antenna at the dam is supported at one end by a 110-foot tree, and the other end is attached to a 170-foot cliff on one side of the canyon.

Both sets operate on a frequency channel of 2,222 kilocycles. The call letters KTGS for the Gunnison Station and KTGT for the Taylor Park Dam Station were assigned by the Interdepartmental Radio Advisory Committee.

The sets are operated by 110 volts alternating current power supply. Commercial power is not available at Taylor Park Dam and consequently a small gasoline-engine driven alternating-current generator was installed to furnish power for this set.

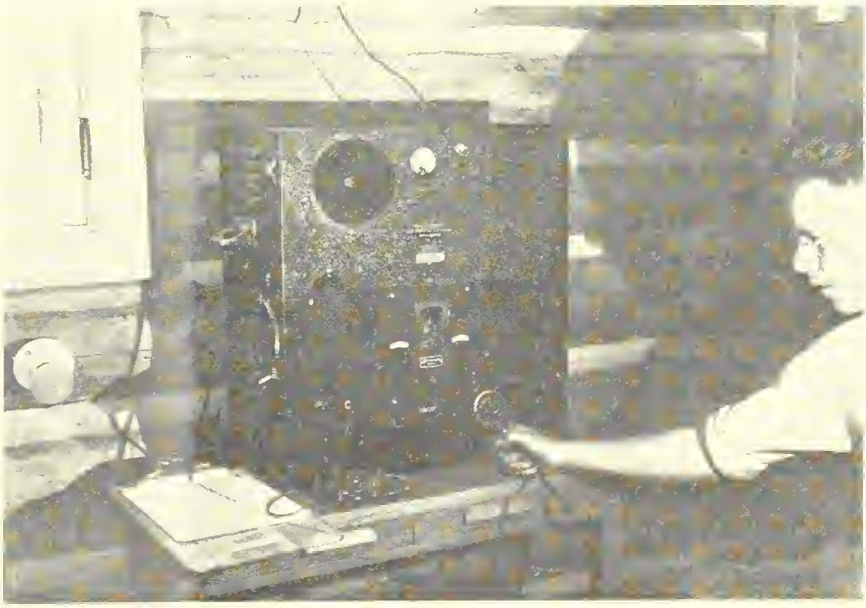
This radio equipment has been in service since May 1, 1936, and communication has been very satisfactory. Approximately 93 percent of the attempted contacts have been successful. Contacts are usually made three times daily at 8:15 and 11:45 a. m., and 4:30 p. m., except on Saturday afternoon and Sunday. The comparatively large amount of power used for the relatively short distance is due to the mountainous country between the two stations and to the unfavorable conditions at the dam, where the station is located in a deep canyon.

THE Klamath project reports additional sales of farms on the Tule Lake division during November. In addition, 1,190 acres recently patented to the Colonial Realty Co. were sold.

Conchas Dam

The Conchas Dam is being constructed by the Army Engineers across the South Canadian River in San Miguel County, N. Mex., about 27 miles north of Newkirk. Flood control is the purpose of the project, with irrigation and municipal water supply as possible benefits but not included in the present work. The main dam is a concrete gravity structure, approximately 220 feet high and 1,250 feet long, with earth dikes on each side extending the overall length to about 4 miles. About 650,000 cubic yards of concrete will be placed in the dam and 3,500,000 cubic yards of fill material in the dikes. The reservoir will have a capacity of 600,000 acre-feet.

An allotment of $30,000 from the Public Works Administration is now available to the Bureau of Reclamation for an investigation of irrigation possibilities from the Conchas Reservoir. J. A. Keimig is in charge of the field office at Tucumcari, N. Mex.



Lake Mead Does Not Alter Weather

HAS LAKE MEAD, more than 100 miles long and the largest man-made body of water in the world, exerted any influence on the weather and climate of America's driest desert, in the heart of which it was created by construction of Boulder Dam in the Colorado River? This question, about which there has been much speculation, now can be answered, "Emphatically, no."

"Lake Mead was not expected to influence the weather of the Southwest", John C. Page, Acting Commissioner of the Bureau of Reclamation, said recently. "It has not done so and it will not."

An investigation was begun last summer when unauthoritative statements were circulated that perceptible changes in the climate and weather were resulting as Lake Mead grew behind Boulder Dam. The Bureau of Reclamation had calculated in advance the rate of evaporation from Lake Mead which could be expected. These calculations indicated that insufficient moisture would be lost to cause a noticeable alteration in weather conditions. A series of tests are now underway to check precisely the amount of evaporation actually occurring, and while the records obtained are too short to be conclusive, they indicate the calculations made in advance will be found to be closely accurate.

Not wishing to await the conclusion of these tests, information was sought by the Bureau of Reclamation from residents near Boulder Dam, from airplane pilots who fly over Lake Mead each day, and from meteorologists of the United States Weather Bureau at Phoenix, Ariz., Reno, Nev., and Salt Lake City, Utah, who are in charge of the weather records of the vast area surrounding Lake Mead.

J. Cecil Alter, meteorologist for the Weather Bureau at Salt Lake City, summed up the evidence obtained with this observation:

"By comparison, the water in a pitcher on a speaker's stand is about as effective in air-conditioning an auditorium as Lake Mead is in modifying the climate."

Seventeen pilots and copilots of a great western air line which sends planes daily across Lake Mead were questioned. Fifteen reported they had noticed no change in atmospheric conditions. Two said that they believed the time which has elapsed since Lake Mead began to form in February 1935 was too short to make any change evident.

Residents near Boulder Dam and in cities close by the lake said they had noticed no difference in the climate.

George V. Sager, associate meteorologist of the Weather Bureau at Reno, said, "The creation of Lake Mead has had no appreciable effect on the climate of southern Nevada."

Summer rains over southern Nevada are generally thundershowers. Masses of moist air from the Gulf of Mexico move inland over Mexico and thence into Arizona and New Mexico during the summer, commonly resulting in intense local storms of cloudburst proportions.

"The rains in the southern and eastern portions of Nevada this year in August were of this type", Mr. Sager said. "When the area of Lake Mead is compared with the thousands of square miles over which such showers are distributed, and when the fact that the vapor of evaporation from the lake surface is being constantly carried away and mingled with dry air over a vast area is taken into account, it is at once apparent that no important effect on local rainfall is likely to be found."

Walter B. Hare, meteorologist of the Weather Bureau at Phoenix, said it was possible that humidity within a radius of a few miles of the lake might be raised sufficiently to be noticeable in records kept over a long period of time but that the effect of Lake Mead on the climate otherwise would be negligible.

"Circulation of the atmosphere is such", Mr. Hare said, "that much of the moist air rising from the lake will be carried entirely out of the State of Arizona. Moreover, regardless of the direction of its movement, it will become so diffused and scattered over such a wide area that its influence will be reduced to a minimum."

In the opinion of Mr. Alter, stationed at Salt Lake City, Lake Mead does not exert any appreciable influence on the climate, even of its immediate surroundings. He quoted the weather records of Utah which showed deficient precipitation during several months since Lake Mead has grown to be the largest artificial lake in the world. During other months of this period precipitation has been greater than the normal.

"These same variations could undoubtedly have been expected", Mr. Alter said, "had there been no Boulder Dam, as they are considered to be entirely within the control of the usual precipitation-producing influences."

In 1905 and 1906 the Colorado River broke its banks and overflowed into the Imperial Valley of southern California, forming Salton Sea in what previously had been a desert basin. Before the river was returned to its channel, Salton Sea had covered 440 square miles. Mr. Sager points out that it has been conclusively shown that the creation of Salton Sea had no effect on the rainfall of its surrounding area and none on the temperature and humidity of areas more than a quarter of a mile from its shores. Yet the surface area of Salton Sea was more than twoce that of Lake Mead.

Construction of Boulder Dam and creation of Lake Mead have exerted and will continue to exert a great influenee on the Southwest, according to Acting Commissioner Page, who further stated: "The character of the Colorado River below Boulder Dam has been changed entirely from an erratic stream to a perennial stream on which irrigators can rely confidently. The contributions made by Lake Mead through control of floods and through increasing the flow of the river during summer droughts have added to the security of tens of thousands. No magical influence on the climate of the Southwest has been claimed for this project and none is necessary to its complete justification."

New Ideas in Irrigation Agriculture

The irrigation farmer today, faeed with changing economic conditions and keen competition, knows that he must be alert to every practical plan that will give better results in the use of land and water, cut down the labor and expense of producing crops, and increase crop yields.

To meet the growing need of project farmers for ideas and plans in irrigation agriculture and to solve problems connected with soil disability, use of land, the Operation and Maintenance Division of the Bureau of Reclamation has prepared a set of colored lantern slides entitled "New Ideas in Irrigation Agriculture."

Any group interested may obtain this valuable set of slides for a showing in their community by contaeting their field supervisor or writing J. C. Page, Acting Commissioner, Bureau of Reclamation, Washington, D. C.

CARLOAD shipments of the principal products grown on the Yakima project for the season to December 1, totaled 14,493 as compared with 10,617 for the same period in 1935. Apples, pears, and potatoes topped the list in the number of carload shipments—4,303, 3,737, and 2,126 respectively.

The Sacred Buffalo Stone

By Seth H. Dibble, Assistant Clerk, Milk River Project

SACRED BUFFALO STONE FOUND ON TOP OF A HILL EAST OF NELSON RESERVOIR AND PLACED IN MALTA CITY PARK.

FROM the time the first ripple of European civilization touched the shores of America, the Indian has been unable to tell the white man who the people were that made the flint arrowheads. Neither from memory nor by folk-tale can they explain them. They and their ancestors used bone. Nor is it possible by the same means to fathom the mystery of the sacred buffalo stone, where, from its elevated position above the Milk River project headworks of the Saco-Hinsdale section, it has watched history in the making, from the receding of the glaciers down to the time when man-made fulcrums lifted it from its age-long bedground and it was removed to Malta. Science explains why it was there. Science explains how it came to be fashioned like a wounded buffalo, in a recumbent position, with neck stretched along the ground. But no man knows what human hands increased that likeness by crudely carving horns, ribs, eyes, ears, nose, and mouth. The jaws of a mighty glacier sheared it from some red granite cliff far to the north and left it on a mesa just east of the Milk River project Nelson Reservoir some 50,000 years ago. The crunching and grinding of those same jaws, during the process of transportation, formed its buffalo semblance, but just when the carving was done is beyond human ken.

Ruts made by the trailing travois, pinto-pony drawn and still plainly discernible, lead to it from the north and vanish in the south, as they skirt the badland coulees and waterholes and climb the adobe hogbacks on their snakelike way. Coming from the north, this trail crosses the Milk River project at a ford known as Cree Crossing, a point where the Nelson Reservoir spills its accumulated waters back into the river to be diverted farther down for the Glasgow division.

One can picture the air filled with alkaline dust and pungent with sage, as the trekking band pours down from the mesa heights onto the cottonwood-fringed flats of the Milk. Noiselessly they come. Perhaps the whinny of some piebald mare for her foal, or the tinkle of clamshell wampum; perhaps the warning buzz of a distrubed rattler, or the bark of a dog as a rabbit breaks cover, but the feather-bedecked ponies trail quietly, fetlock deep in the spongy soil, and the loaded travois dig the ruts a little deeper as they silently drag along.

Were these ruts made by Indians come to worship? Was this stone some sacrificial altar whereon offerings were made to the gods before the buffalo hunt? Or was it? No one knows.

Gravel crunches and stones rattle as the band arrives at the river. Squaws pitch the tepees and prepare the evening meal, while the hunters replenish their supply of kinnikinic from the inner willow bark; children skip stones across the water, while maidens, with keel and cobalt, indulge in the age-old art of makeup.

INDIAN CEREMONY

As the great-orange, hunting moon glides silently from the distant prairie rim, the Indians climb the heights to the sacred stone. Buffalo-chip fires are built. Medicine-men begin their incantations, as they toss their wampum offerings into the cup-like indenture on the sacred hump. To the tum tum-tum, tum tum-tum of the resonant deer-skin drum, the braves join hands, and keeping step with its weird cadence, circle the stone to the left, while

(Continued on p. 16)

"CREE CROSSING", A FORD OF THE MILK DERIVING ITS NAME FROM ITS USE BY CREE INDIANS ON THEIR ANNUAL BUFFALO HUNTS INTO THE COUNTRY NOW COMPRISING SOUTHEASTERN MONTANA AND NORTHEASTERN WYOMING.

A Reclamation Engineer's Vacation[1]

By W. I. Swanton, Bureau of Reclamation, Washington, D. C.

FOR a long time we (my two daughters, son, and self) had desired to visit Yellowstone and other national parks, to see the progress on Grand Coulee and Boulder Dams, to see some of the results of western irrigation, and to swim in the Pacific Ocean.

Opportunity came this summer during a visit to the West. Starting from Denver, we made a 5,000-mile trip covering 10 of the 11 far Western States, visiting 4 national parks, 5 dams under construction, 2 completed irrigation projects, and had our swim in the Pacific Ocean, all in less than 3 weeks.

On July 2 we started north from Denver on Route 287. At Fort Collins a brief stop was made at the hydraulic laboratory where so many valuable experiments for the Reclamation Bureau are in progress. Continuing north and west we turned at Parco, Wyo., over a rough gravel construction road along the North Platte River and visited the construction work on the Seminoe and Alcova dams. We passed through Lander, full of cowboys and Indians, and spent the first night at Riverton, Wyo., 486 miles from Denver, and in the evening called on Superintendent Comstock and his family.

YELLOWSTONE PARK

The next day, up bright and early again, we crossed the Wind River Dam and stopped to watch the construction work on Bull Lake Dam, 3 miles from the main highway. On the Divide between the Wind and Snake River Valleys we obtained a fine view of the Teton Range and visited Jackson Lake Dam with its fish ladder and log way. During the drive through the Yellowstone Park to Canyon Lodge, from the south entrance, we stopped to see the hot springs and mud volcanoes. After securing cabins, we went sightseeing and were waylaid by the black bear bandits, but after partially satisfying their appetites, escaped in time to see the grizzlies fed, from a safe vantage point, on "combination salad" from the hotel tables. In the evening the hostess at the hotel led the singing by the hundreds present, and dancing followed after an entertainment by a group of college students.

In the early morning of the Fourth of July, wood fires in the cabins were appreciated, and after breakfast and a drive of 44 miles to Old Faithful Geyser we were again waylaid by one of the bandit bears with two cubs. We were fortunate in arriving at Old Faithful just before one of the hourly eruptions and soon were on our way out of the west entrance and on through the beautiful Madison River Valley. We reached Missoula, Mont., 372 miles distant, in time to secure the last cabin, a converted streetcar with a shower on one platform, a kitchen on the other, and comfortable sleeping quarters inside.

ON TO GRAND COULEE

The next day we continued our drive through beautiful country over the Continental Divide at an elevation of 4,738 feet into the Panhandle of Idaho, along the Clark Fork, and by the shores of the Coeur D'Alene Lake. Arriving at Spokane on Sunday at noon we reached Grand Coulee dam site in good time, and later viewed the immense operations in progress from U. S. Vista Point. The mighty Columbia, with an average of 10 times the flow of the Colorado, was still in flood, and plans were already being formulated for the diversion of the river in November. We stopped at the Mason City Hotel and that evening dined at the company mess, together with thousands of workmen. We had plenty to eat and it was all fine and well served. In the evening we attended the one movie theater and saw a typical western thriller with lots of riding and shooting.

Monday morning we visited the administration building and from there Mr. Markhus took us over the project. We saw at close range the continuous concreting operations with the batch mixers, the proportions being accurately regulated by the pressing of electric buttons. More than 6,000 cubic yards of concrete were being placed each day and the contract was months ahead of schedule. At noon we left for Yakima, passing through the Grand Coulee with high palisades on each side, and stopped at Dry Falls, a unique geological wonder in the former bed of the Columbia. Then we drove over a part of the arid and dusty deserted Columbia Basin project lands, which are awaiting the magic of water to transform them into prosperous and happy homes.

SEEING YAKIMA

Crossing the Columbia at Vantage Bridge we soon were in Ellensburg with its green farms and evidences of substantial prosperity, and reached Yakima, 180 miles from Grand Coulee Dam, before closing time. Supt J. S. Moore was busy mailing out his comprehensive and informative monthly report to Washington, but kindly invited us to drive over the irrigated lands in the vicinity, which invitation we accepted with pleasure. The trip with Mr. Moore was interesting and instructive. From a high hill we could view the rich apple, pear, and cherry orchards for which the Yakima Valley is famous. Our tour ended at his hospitable home, where Mrs. Moore served us some of the delicious large black Yakima cherries.

Tuesday morning we stopped for a brief call on Construction Engineer C. E. Crownover, in charge of the Roza division, and then pushed on through Union Gap along the Yakima River to the Sunnyside Dam. We again crossed the Columbia, this time by the Mayhill ferry, and after a short ride on the beautiful Columbia River Highway as far as The Dalles, we turned southerly through Deschutes River Valley. At one time we could see four snow-capped peaks of the Cascade Mountains—Adams, Hood, Jefferson, and Rainier. At one place our passage was interrupted by an immense flock of sheep. We were glad to reach Crater Lake Hotel and a big fire after passing through remains of snowdrifts more than 10 feet high. The deep azure blue lake was admired by all of us and the park ranger's lecture in the evening on the strange geologic structure was very interesting.

With our auto heater on in the early hours of the next day, we headed for California and the Redwood Highway. At the State line we successfully passed the scrutiny of the fruit inspectors, and caught our first view of the fog-bound Pacific at Crescent City. We followed the winding road, at times through the groves of giant redwoods, and camped in one of the groves for the night on the banks of Eel River.

SAN FRANCISCO TO LOS ANGELES

On Thursday we visited the Luther Burbank house and gardens at Santa Rosa where we purchased some delicious Burbank plums and also seeds for our garden. At noon we caught our first view of the beautiful San Francisco Bay, and as we crossed on the ferryboat we obtained glimpses of the famous Golden Gate suspension bridge with its towers lost in the low-hanging clouds. Far to the left stretched the long East Bay bridges well along toward completion. After a few

[1] A western auto trip of 5,000 miles to the west coast from Denver, Colo.

calls in 'Frisco and a visit to Golden Gate Park and the Japanese Tea Garden, we arrived at Palo Alto for the night, where we called on friends and drove around the Leland Stanford University campus and by the residences of former President Hoover and former Secretary of the Interior Wilbur.

On Friday we detoured from the main highway to Los Angeles to call on the late Lincoln Steffens at Carmel-by-the-Sea, then still keenly interested in world affairs. Proceeding southward, with occasional glimpses of the Pacific, we stopped for the night at a tourist cabin camp in a large walnut grove near beautiful Santa Barbara. We passed along many of the beaches, for which southern California is famous, and noted with interest the oil derricks far out in the Pacific Ocean.

Saturday morning we were within 100 miles of Los Angeles along the ocean beaches, and the last 15 miles from Santa Monica were over the famous Wilshire Boulevard, reputed to be the most congested thoroughfare in the world. After lunch we drove out to the famous Hollywood Bowl, and climbed the hill to the Japanese Tea Gardens overlooking the city. I believe in all our trip the one thing that appealed to me with the most force was the immensity of the city of Los Angeles, the largest city west of Chicago, and to realize that in 1923 it was the second seaport in the United States in foreign and coastwise tonnage. We had a pleasant visit at Beverly Hills with Mr. Bissell, formerly of the Washington office of the Bureau. The next day we followed the immense crowds to the beaches and enjoyed a swim in the warm waters of the Pacific Ocean at Redondo Beach near Palo Verde.

IMPRESSIVE BOULDER DAM

Monday noon we left the cooling breezes of the Pacific and drove over the HOT Mohave Desert to Boulder Dam, 340 miles distant. Our route lay over Cajon Pass through Victorville and Barstow along the double tower electric power transmission lines, completed and awaiting the current from Boulder Dam power plant.

The next morning we visited the Reclamation offices, and Construction Engineer Lowry furnished us with passes to the power plant. On arrival at the dam we parked on the 45-foot roadway and descended 528 feet by an elevator with 20 other tourists to the power plant, where we were shown through the immense structure with its large force of men assembling the turbines and 115,000-horsepower generators. Water was pouring through outlet gates on the Nevada side to meet downstream irrigation requirements. The reservoir was nearly one-third full, with more than 9,000,000 acre-feet of water as an insurance against future crop demands. By 10 o'clock we were on the Kingman Highway in Arizona, and at noon on the Santa Fe Trail for Grand Canyon National Park. We arrived in time to view the weird and fascinating canyon before sunset, and in the evening Indian songs and dances were enjoyed by the large number of tourists present from all parts of the country. The entire next day was occupied in viewing the canyon, including a lecture by one of the Kolb Brothers who had braved the terrors of the Colorado River rapids. In the afternoon we joined the auto caravan, which wound its way along the rim of the canyon as far as Point Moran.

THROUGH NEW MEXICO

On Thursday, July 16, an early start was made for New Mexico. At Flagstaff we made a slight detour to see the remains of the cliff dwellings at Walnut Canyon. At Holbrook another detour was made to see the famous petrified forest, and before reaching the reservation fine specimens of petrified wood were secured. At Gallup, N. Mex., our route led north through the Navajo Indian Reservation. An Indian thumbed us for a ride on the running board, the only place available, and three raps on the roof indicated when he wanted to get off. Farther along, we met a family whose spare tire had failed, and they were assisted to the nearest town for repairs.

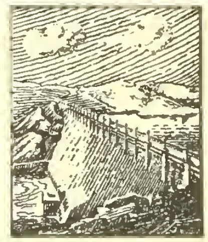
Friday morning an early start was made from Farmington, N. Mex., and a visit to the cliff dwellings in the Mesa Verde Park with its beautiful views from the top of the mesa well repaid us for the trip. It was about 120 miles from Durango to Montrose over the "Million Dollar Highway" through the Rockies and the most beautiful scenery of the entire trip was thoroughly enjoyed. The trip took 5 hours around hairpin turns and through the famous mining towns of Silverton and Ouray. Montrose was reached in time to listen to a fine concert by the high school band on the court-house steps. If one desires to go into the heart of the rugged Rockies, take this ride and you will be well repaid with the continuous panorama of unsurpassed grandeur.

MONTROSE AND DELTA CANAL, UNCOMPAHGRE PROJECT, COLORADO.

Before starting for Denver on the last day of the tour the Black Canyon of the Gunnison Monument was visited with its 2,000-foot deep canyon and echo. Monarch Pass on route 50, with an elevation exceeding 11,000 feet, was successfully passed in a heavy rainstorm and slushy snow, arriving in Salida in time for a late dinner. In spite of the rain and flooded roads, we arrived at Denver that evening, tired, but feeling well repaid for our sightseeing trip of 5,000 miles through the Reclamation States in less than 3 weeks. The educational and recreational value of such a trip is incalculable, especially to young people.

In closing, it may be of interest to others planning a similar trip to know that for our party of four the cost of oil and gas for the car averaged exactly 1.4 cents per mile; cabin and hotel accommodations averaged $1.10 each per day; and food almost exactly the same amount.

ENGINEERING



Freezing Arch Across Toe of East Forebay Slide, Grand Coulee Dam

By Grant Gordon, Associate Engineer, Bureau of Reclamation, Columbia Basin Project

THE Grand Coulee Dam rests on a foundation of solid massive granite of exceptionally fine quality. The over burden directly above this bedrock is a glacial silt consisting of ultra fine rock flour ground up by the ice sheets as they advanced across the country rock. This silt is extremely fine and contains 20 to 25 percent of colloidal material. Shear tests on the silt, made on material in place, have yielded a value of approximately 400 pounds per square foot. The behavior of the material before being disturbed is entirely unlike that after disturbance, especially if moisture is added. Undisturbed, and in its original horizontal bedding, it will stand indefinitely in a vertical face of moderate height, but once disturbed, it is unstable on any slope steeper than 4 to 1 even when comparatively dry. This fact has been demonstrated repeatedly in the progress of excavation operations at the dam. It makes no difference whether the disturbing cause is excavation operations or simply undercutting by the river. The slope of the spoilbank in Rattlesnake Canyon and the various slides in the excavation areas are typical examples of the tendency of steep slopes to flatten to a 4 to 1 slope. When moistened and disturbed the material takes on the consistency of axle grease. When dry and pulverized it forms an impalpably fine dust.

This material filled the canyon of the Columbia River at the Grand Coulee dam site to a depth of approximately 500 feet. The river has since cut its channel back through the silt to within 40 or 50 feet of bedrock. During the cutting operation the river has swung from side to side in its channel, undercutting the silt slopes formed on both sides of the river, and removing the support formerly provided by the material in the channel section. Consequently the slopes on both sides of the river are the scenes of both ancient and recent slides. The entire mass of overburden above bedrock has been disturbed from the original bedding to a greater or lesser degree, and consequently has a low and variable degree of stability. The older slides have reached a condition of equilibrium which is stable under ordinary conditions, but the removal of the enormous quantities of overburden required for the construction of the dam, has upset the conditions of equilibrium so severely, and removed so much support from the toe of the ancient slides that further slides into the excavation were the inevitable result. A number of such slides have occurred, including one at the west power-house site, another at the west tailrace slope, one at the east pier of the highway bridge, one on the east forebay slope, and several minor slides at various points bordering the excavation areas.

Treatment of the various slides has varied with the particular conditions obtaining in each case. Drainage by tunnels and wells wherever feasible has been used to remove underground water to prevent saturation and consequent lubrication. Surcharge has been removed in some cases, and additional weight added to the toe in others, in order to reduce the tendency toward sliding. A particular combination of conditions led to the adoption of a unique method in treating the east forebay slide and to this slide our attention is directed.

CONDITIONS AT EAST AREA

Near the center of the east excavation area the bedrock is transcepted by a long narrow gulch, 120 feet deeper than the average elevation of the bedrock surface, which is 880, and 175 feet lower than low-water surface, which is 935. The gulch runs parallel to the river and crosses the axis of the dam at nearly right angles. The walls of the gulch are nearly vertical, and at a point 60 feet upstream from the axis of the dam are only 100 feet apart. This gulch has introduced a number of complications in the excavation program. The removal of the overburden with which it was filled was at best a slow and expensive operation because of the inaccessibility of the floor of the gulch. The filling was removed by dragline and power shovels. To reach the bottom a steep ramp was required to be built, and the muck hauled laboriously up the ramp in trucks towed by caterpillar tractors.

The shape, size, and depth of the gulch were accurately predicted from diamond drill borings. From the information furnished by these borings excavation slopes were laid out at $1\frac{1}{2}$ to 1 from the bottom of the gulch at the beginning of excavation operations. As the excavation neared the bottom of the gulch, a large portion of the forebay slope gave way at the top of the slope and started for the bottom of the gulch. In order to increase stability, the slopes were flattened to a 2 to 1. They were only stable temporarily, and in the early spring of 1936 the entire forebay slope was again involved in a major movement. The slide converged upon a point just upstream from the axis of the dam opposite the south end of the deep gulch and poured through the narrows formed by its vertical walls like a flood of molten lava. The movement was so rapid that a 5 cubic yard shovel working at the toe in the bottom of the gulch could make no headway and was forced to retreat or be buried. A continuous seepage was one of the major contributing factors of this slide. During the last and most violent part of the movement a spring of water broke from the surface of the sliding mass at about elevation 880, or about the average elevation of bedrock, and flowed about 100 gallons per minute for several hours. This water had collected over a long period of time from a general seepage on the forebay slope. Due to its dispersed nature no method presented itself whereby this water might be collected by a tunnel or shaft.

During the short interval during which the bottom of the gulch was exposed, the contractor at his own expense, constructed a small concrete arch dam across the gulch south or upstream of the axis of the dam. The top of this arch was at elevation 800. On the concrete arch was begun the construction of a rock-filled timber crib. This crib was to form the toe of a rock fill across the toe of the slide area. At this period the slide was temporarily dormant, but as the crib reached elevation 815 the slide suddenly became active and immediately overtopped it,

filling the gulch and forcing the shovel to retreat as mentioned above. As this last movement precluded any concreting operations before high water of 1936, all excavation operations were abandoned until after high water and the entire east excavation was flooded.

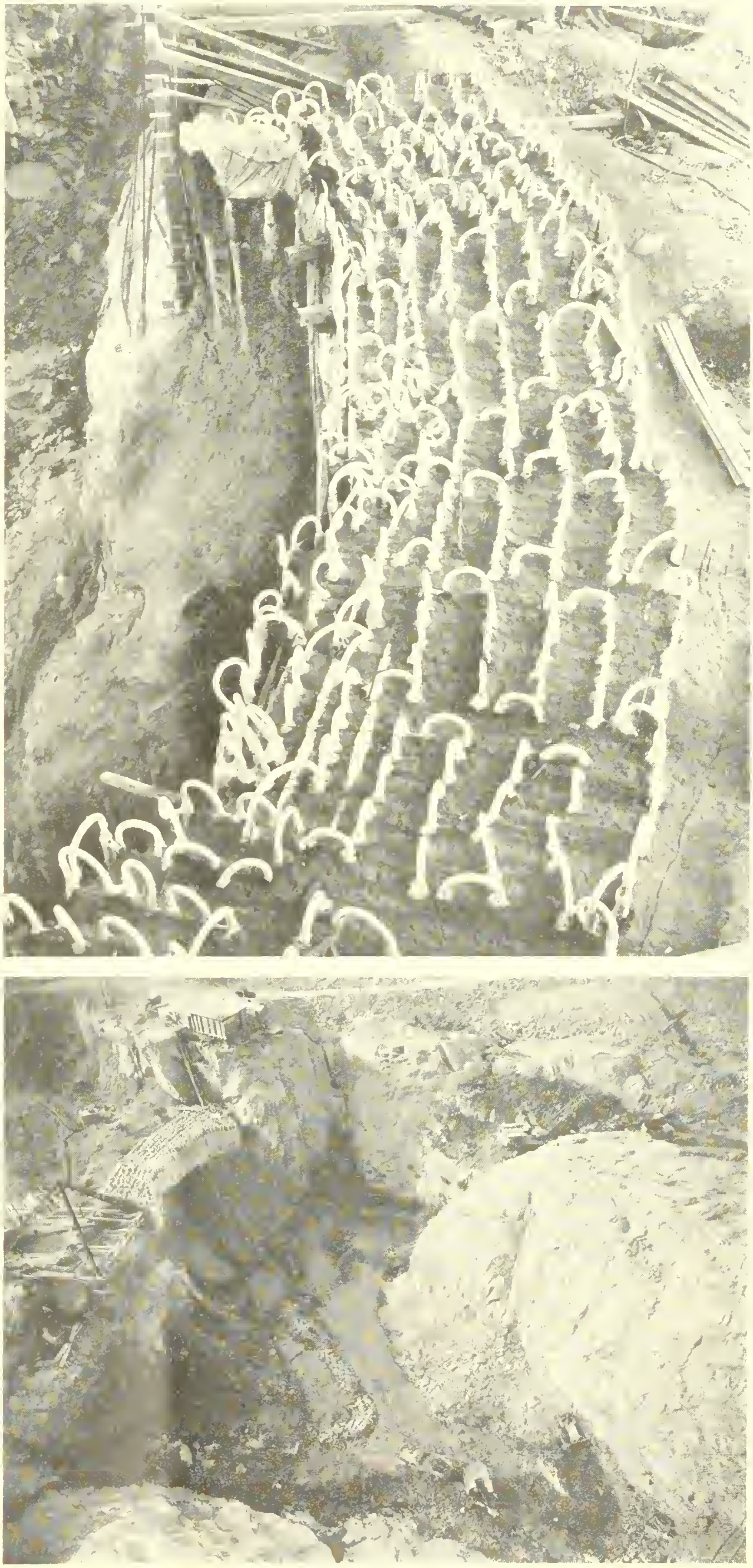
During high water the forebay slopes above water surface were excavated to slopes varying from 2½ to 1, to 3.15 to 1 opposite the south end of the gulch, to remove additional surcharge from the slide. As soon as unwatering operations were begun after high water, a break appeared at the top of the slope and the old slide started to move toward the gulch. The pool was lowered from elevation 965, the top of the east cofferdam, to elevation 850. The slide followed it down. At this point the pumping operation was reduced to that required to hold the water surface stationary. At the time operations were started on the freezing, the slide was moving into the pool at a velocity of about 2 feet an hour.

FREEZING NECESSARY

The slide now presented a real problem. To further flatten the forebay slopes until they were stable was an enormously expensive job. To attempt excavation at the bottom of the gulch without some stabilization was to invite disaster. Drainage could not be solely relied upon, and no method economically feasible offered any hope of success. The expedient of freezing an arch across the slide area between the steep rock walls of the gulch was decided upon. The top of the arch was taken as elevation 855, and in order to promote freezing by maintaining a saturated condition, and aiding stability by its weight against the front of the arch, the pool level was maintained at elevation 850 until the operation was completed. The operations were timed so that freezing could begin as soon as the surcharge back of the arch was removed, and be completed before the contractor was ready to renew excavation operations in the floor of the gulch, after high water.

The arch was intended as a temporary measure only. It was designed to restrain the sliding material for such time as was required to remove the desired excavation and concrete sufficient height of dam to be out of danger from further slides. The cost of the arch as roughly estimated would be covered by the saving in excavation which it afforded, beside the saving in time and money which it afforded the contractor.

Once the course of action was decided upon much had to be done. No criteria existed from former frozen arches. The only information available about similar operations was meager and offered little



NEAR AND DISTANT VIEWS OF FROZEN ARCH.

that could be used. The freezing method invented by F. H. Poetsch, of Prussia, used in sinking deep shafts, was the nearest approach to anything similar, and available information on operation and costs offered little basis for comparison. Accordingly, design and cost data for the entire setup were required to be worked up from scratch. Initial assumptions were made from known refrigeration data, the time available for completion of the arch ascertained, tentative designs sketched out and the Pacific Northwest scoured for available refrigerating equipment which might be rented, or purchased. Finally, two used ammonia compressors were located which had a combined capacity of 80 tons of ice per day, and were immediately available. Using this capacity for one known factor, and the length of time available, for another, the refrigerating plant was designed, the arch laid out, and the number and type of freezing points determined.

Pipe and fittings, equipment, and supplies to be purchased were placed on order and the work of assembly begun. An idea of the progress made is shown by the following dates:

August 6, foundations for compressors poured; August 14, started driving freezing points; August 25, started freezing on first half of arch; September 3, started freezing on balance of arch; and September 18, started pumping out east excavation.

DESIGN OF ARCH

The sliding material completely filled the gulch between its vertical rock walls to elevation 855, at a point above the concrete arch and rock-filled timber crib resting on it. The top of the timber crib was at a elevation 815. An arch was projected which would derive its foundational support from the timber crib and spring against the rock walls of the gulch. A radius of 105 feet was chosen in order to most satisfactorily fit the timber crib and abutment walls. A shorter radius would have decreased the thickness required and consequently the volume required to be frozen, but the arch would have been unsupported in the center section and a tendency toward lifting was feared. Furthermore the arch of shorter radius was more inclined to slip along the abutments.

Assuming a strength of 200 pounds per square inch for the frozen material, the weight of the sliding material as 90 pounds per cubic foot, and 75 percent of full liquid pressure against the arch, a thickness of 10 feet was required at the base, as computed by the cylindrical formula. To provide a suitable safety factor the final arch thickness was chosen as 20 feet.

Assuming that 3 weeks were available for freezing operations, a spacing of 30 inches between freezing points was used. To arrive at this figure it was assumed that with 10° brine 6 inches of material would be frozen in 2 days, 12 inches in 8 days, and 15 inches in 20 days. The figures were based on the rate of freezing of ice and checked by considering the insulating effect of ice around the points. The figures were assumed to be conservative because the specific heat of the material to be frozen was only 0.45 above the freezing point and only 0.31 below. The material in the arch had an average water content of 32 percent by dry weight. Actually the material behaved somewhat differently than anticipated because of its exceptionally high rate of heat conductivity. This resulted in the whole mass lowering its temperature at a surprisingly uniform rate, a distinct advantage in the freezing of the arch.

PLANT DESIGN

An ammonia-brine refrigerating system was selected as most satisfactory. The entire plant was so arranged as to insure as little complete shutdown as possible. The plant was located on the west side of the gulch on the solid rock about 50 feet directly above the west end of the frozen arch. With the exception of the cooling water pump, which was located at the river bank, the entire plant was housed in a galvanized sheet iron building 16 feet wide and 26 feet long. The plant consisted of three separate systems: (1) The brine system which cooled the material to be frozen; (2) the ammonia system which cooled the brine; and (3) the cooling water system which cooled the ammonia.

The brine was cooled by the expansion of liquid ammonia in two brine coolers, each of the shell and tube type, 22 inches in diameter, 22 feet long, equipped with 56 pipes 1¼ inches in diameter and having an effective cooling area of 486 square feet. The liquid ammonia under pressure was admitted from the condensers to each of the coolers through an expansion valve. Either cooler could be operated independently by a simple adjustment of the control valves. The brine was mixed in an insulated wooden surge tank 3 by 9 by 3 feet, having a capacity of 600 gallons and open to the atmosphere. Rock salt was added by hand directly to the brine in this tank and stirred by the agitation of the return flow. The brine was pumped by a 7½ horsepower centrifugal pump through the coolers down to the freezing points and back to the open surge tank. The brine went from the coolers down the side of the gulch through a 3-inch riser to the top of the arch, where it was divided through two 3-inch supply headers. The vertical freezing points were connected 16 in series between parallel 3-inch supply and return headers. The return headers connected with the surge tank by means of a 3-inch riser.

Each freezing point consisted of a 3-inch standard black pipe capped on the lower end with a standard cap and fitted at the top with a 3- by 1½- by 3-inch standard T which admitted a 1½-inch standard black pipe. This pipe was open on the bottom and extended to within 6 inches of the bottom of the 3-inch pipe. The upper end of the 1½-inch pipe was fitted with a 2-inch nipple welded to it and threaded into a 2- by 3-inch reducing bushing in the T. The brine was forced down the 1½-inch pipe and returned through the annular space between the 1½- and 3-inch pipes and emerged through the T. The outlet end of one point was connected to the inlet end of the next in series by means of a 2-inch, 3-ply rubber hose, fastened by two metal clamps on either end. The points were 43 feet long on the average and extended from ground surface to the rock-filled timber crib. Sixteen points were connected in a group in series between headers and the flow regulated through series by means of valves on both headers. The points were spaced 30 inches center to center both ways. The arch was formed by 8 parallel rows of points plus about 25 extra points on each abutment haunch, to increase the bonded area and lessen tendency toward sliding. A total of 377 points was installed and in service.

The ammonia gas from the brine coolers was compressed by two ammonia compressors. One was a Baker 9¼- by 9¼-inch vertical compressor driven by a 60-horsepower General Electric motor. The other was a Frick 9- by 9-inch vertical, driven by a 50-horsepower Allis-Chalmers motor. The compressed gas was condensed to a liquid in two shell and tube type condensers each 20 inches in diameter, 20 feet long, containing 48 tubes 1¼ inches in diameter, and having an effective cooling area of 417 square feet. The compressors, condensers, and brine coolers were connected in parallel in such a manner that by means of valves any item could be removed from service without interfering with the operation of the others.

The condensers were cooled by water pumped from the Columbia River through a 6-inch main by a 50-horsepower, 4-stage, 500-gallons-per-minute centrifugal pump.

The plant was assembled, installed, and operated, under an extra work order to

the Mason-Walsh-Atkinson-Kier Co., contractors for the foundation of Grand Coulee Dam. The compressors, condensers, coolers, and their appurtenant piping, wiring, etc., were installed in accordance with standard methods and no special description is necessary. The freezing points were installed in the following manner:

(1) The 3-inch pipes forming the outer wall of each freezing point were driven to place by two rigs. One was a caterpillar-mounted, walking-beam type churn-drilling outfit, and the other was a gasoline-powered, diamond-drill rig mounted on a derrick barge. The barge floated on the pool in the excavation, which stood at elevation 850 during the entire operation. The 3-inch pipe was furnished in stock lengths of 21 feet plus, and most of the points required 2 lengths. The first joint was driven by a 300 pound drop-hammer striking against a heavy drive coupling, the second joint was coupled on and the point driven until it came up on the timber crib below. Each rig averaged about one point completed per hour. The barge rig drove the points at the edge of the pool and as far inland as it could reach, while the well rig drove the remainder. It was found that the blunt end formed by the standard pipe cap allowed the points to be driven more nearly plumb than a sharp point, because of the tendency of the latter to deflect when gravel or other hard object was struck.

(2) Next, the T's and reducing fittings were installed by a pipe-fitter crew following closely behind the driving. In cases where driving was difficult, it was necessary to rethread some of the pipes. All the points were tested under 100 pounds of air pressure before hooking up.

(3) The 1½-inch pipes were installed and the 2-inch nipple in the T welded to the 1½-inch pipe while it was held 6 inches above the bottom of the 3-inch pipe.

(4) The groups of 16 points were connected in series and to the supply and return headers by means of 3-ply hose. As each group was completed it was filled with brine and placed in service.

(5) After thorough testing, the arch and exposed mains were insulated by means of a 2-foot layer of sawdust.

OPERATION

At the beginning of freezing operations both machines were operated at full capacity. After 6 weeks' operation either machine maintained the low temperature of the arch handily. Under full operation the temperature difference maintained between incoming and outgoing brine was 8° F. As the arch temperatures dropped, this difference remained constant until an arch temperature of 30° F. was reached, or until most of the latent heat of fusion was removed and the moisture was frozen. Below this temperature the difference became less as the refrigeration requirement lessened. The 8° difference corresponded to a net effective refrigerating capacity of 70 tons of ice per day.

The brine circulation velocity was controlled by valves to balance the refrigeration between the 24 groups of points, and was maintained at about 1 foot per second through the freezing points. The total circulation required was 170 gallons per minute. Because of the temporary nature of the set-up, ordinary rock salt was chosen for the brine because of its economy. The solution was maintained at about 95 percent saturation, or a relative density of approximately 1.2. The brine had a freezing point of about −4° F. when still, but was kept in constant motion. Approximately 20 tons of salt were required to charge the system. It was delivered to the job in 120-pound bags.

Under full load the compressors were operated with a back pressure of 125 pounds per square inch and a suction pressure of 20 pounds per square inch. As the required capacity dropped off, the suction pressure was held at 10 pounds per square inch and the back pressure dropped to 105 pounds per square inch. A total of 2,200 pounds of ammonia was required to operate the system efficiently, very little being lost by leakage. The ammonia was admitted to the system through a valve just ahead of the expansion valve.

The condensing water from the river cooled the compressed ammonia to the condensation point with a 6° F. temperature rise. The temperature of the river water varied from 53° to 60° F. Since ample quantities of water were easily available there was no point in being economical with it and the pump was operated at normal capacity.

OBSERVATIONS

Daily observations were made on temperatures in the frozen arch. Observations were also taken on 10 equally spaced points on the arch, for movement up or down stream. In addition, studies were made on the behavior of frozen materials similar to those in the arch. Cylinders 6 by 12 inches of the material were frozen and crushed in a compression machine and the stress strain relations carefully noted.

COMMENTS

At the time driving operations were begun on installation of freezing points, the material in the center of the arch was moving downstream at a velocity of 2 feet per hour. During these operations, however, the material reached a fairly stable state of equilibrium, and for the week prior to start of freezing no movement was detected. However, as soon as freezing began, the arch began to develop load. It is believed, and analysis bears out the conclusion, that the major portion of the load and consequently the movements in the arch were due to expansion of freezing material. Since all the material composing the arch had been violently disturbed and broken up during sliding, there was a considerable volume of voids to be consolidated. The major movement was downstream at a steadily decreasing rate, but daily observations show an oscillation up stream and down as the material adjusted itself to its self-imposed load. No movement was observed on the abutments. The observations were taken on the ground surface, and it is believed that the lower 30 feet of the arch did not move to any great extent.

The arch was designed to derive its main support from the timber crib beneath, and it was also assumed that drainage of ground water from the slide area would take place through the crib. However, it was believed necessary, during the period before the earth in front of the dam was removed, to sink a drainage shaft 30 feet upstream of the arch to elevation 800 to remove ground water and thus prevent development of liquid pressure against the frozen arch. This well produced a flow of approximately 25 gallons per minute. As soon as excavation in front of the dam was completed as low as the crib, drainage took place as anticipated, and the well was no longer required.

No particular difficulties were experienced in maintaining a balanced rate of freezing in the various groups of points by a simple manipulation of valves. Thermometer wells made of ½-inch pipes 10 feet long were driven at frequent intervals throughout the arch to give an accurate check on the rate of freezing; balancing was done simply by observing the amount of frost on the exposed hoses.

Some difficulty was experienced with air trapped at the high points of the hoses connecting adjacent freezing points, until the expedient was adopted of making a small hole in the top of each hose, allowing the air to escape, and then plugging the hole with a toothpick or shingle nail.

Considerable difficulty was experienced driving the second joint of pipe because of the tendency of the driving coupling to batter the threads on the pipe. It

was found that a heavy hammer, 300 pounds in this case, drove the pipe easier and with less damage to the threads than a lighter hammer. All the leaks in the freezing points were at the couplings joining the lengths of pipe. Great care was necessary in joining the two lengths to make them withstand driving.

A total of 10 points failed while in service. These points invariably broke at the coupling. Thrusts developed by expansion during freezing bent the pipes out of line as much as a foot in some cases before failure took place. This expansion is due partly to the tendency of the larger particles of water in the soil to freeze first, and to draw to the resulting crystal smaller particles from the adjacent capillaries which individually do not freeze at ordinary freezing temperatures. When drawn to the existing ice crystal, these small particles freeze and increase in size. Continuation of this process increases the size of the original ice crystals as long as the fine capillary water supply is replenished from the ground water supply. The lenses of ice formed by this process were visible in the face of the arch when the earth in front was removed. The upper portion of the arch, being less confined, moved more than the lower portion. This put a shearing stress, and in the case of the vertical component, a tensile stress on the coupling. Points which failed were removed from service and no difficulty was experienced in maintaining low temperatures without them because of the high rate of heat conductivity of the material. Blasting operations on the rock excavation for the foundation of the dam complicated matters somewhat. Flying rocks cut off the hoses connecting adjacent freezing points, and jars from the blasts frequently broke points already stressed to the limit. It was necessary to be constantly on the alert to avoid heavy losses of brine from leaks through broken hoses and points. To minimize these losses, a float switch was installed in the brine surge tank so that a drop of 0.01 of a foot was sufficient to ring a bell to warn the plant operator. The scheme worked satisfactorily. Brine which leaked out through broken points found its way down the points and drained away through the timber crib without causing any particular damage.

Costs.—The cost of freezing the arch, 100 feet long, 20 feet thick, and 40 feet high, containing about 3,000 cubic yards was $30,000, or a unit cost of $10 per cubic yard.

Against the cost of the frozen arch is credited an actual saving of not less than 30,000 cubic yards of excavation otherwise required at $1 per cubic yard, the contract price. In addition a saving of several weeks of the contractor's time in excavating and concreting the bottom of the gulch, with its attendant speeding up of all operations contingent upon it and consequent saving of overhead and contingent expense is to be credited. And also to its credit is the stabilizing of the entire forebay slope which converges upon the south end of the gulch. The amount of yardage which might be involved is impossible to estimate, but to anyone who has observed the movements of that slide over its period of activity, the 30,000 cubic yards actually credited seems but a small fraction of what would certainly slide if a shovel ever started excavating at the site where the frozen arch now stands.

Sacred Buffalo Stone

(Continued from p. 9)

the squaws form an outer circle, where they sit swaying from side to side, chanting the Indian hunting song.

A skulking wolf watches intently from a distant hill. A prairie mouse peeps from the eyesocket of a buffalo skull nearby. But the shuffling pad of moccasined feet, the weird tempo of the drum, and the wailing chant of the swaying squaws continue as the medicine-men implore their gods to make the morrow's hunt yield much meat and many hides.

Has this stone buffalo watched such sacred rites by Sioux or Assiniboine, Cree or Crow or Mandan, for thousands of years? Perhaps. Who knows?

Today, the buffalo has stampeded beyond the horizon and the Indian is rapidly approaching its edge. The elements are gradually filling the travois ruts and Cree Crossing is spanned by a low, solid concrete planking, with large, corrugated piping for piers. White children skip stones across the water and project family daughters apply lipstick, while they sun-tan along the sands.

The travois ruts, leading from the crossing, have widened into an auto trail, that hugs the spillway coming from the reservoir. It crosses dams and dikes and ditches, and zigzags between alfalfa and wheat and beet fields, and finally joins its younger, sleek-coated brother—Roosevelt Highway No. 2.

And the sacred buffalo stone? When the elevators and beet dumps and seed houses are silhouetted against the rising moon, one can imagine the shades of departed braves gathered in the city park as they shuffle to the tum tum-tum of ghostly drums.

Ogden River Project

The Utah chapter of the National Association of Purchasing Agents met in Ogden, Thursday, November 5, 1936, and was entertained by the Ogden members of the chapter. The members in attendance visited several of the Ogden industrial plants and also the Pine View Dam in Ogden Canyon, which is nearing completion. In the evening, at a dinner, H. W. Johnson, Chief Clerk of the Ogden River Project, spoke, explaining the purpose of the dam and other project features. In harmony with the nature of the organization addressed, a brief résumé was made of the purchasing activities of the Bureau of Reclamation for the Ogden River project. This summary developed some information regarding the extent of the territory furnishing materials for the project that may be of more general interest. It was found that carload shipments had been received from 15 States, other than Utah, as follows:

New York.—Twenty-seven cars of 38-inch steel pipe, 7 cars steel piling.

Pennsylvania.—Seven cars steel piling.

Alabama.—One car structural steel, 3 cars gate valves.

Virginia.—One car structural steel.

Michigan.—One car cast-iron valves, 1 car automobiles.

Ohio.—One car small iron pipe.

Indiana.—Two cars reinforcing steel.

Wisconsin.—One car structural steel.

Illinois.—5 cars steel pipe, 4 cars shoe castings for wood stave pipe, 7 cars reinforcing steel.

Iowa.—2 cars corrugated metal pipe.

Missouri.—1 car fencing material, 3 cars reinforcing steel, 1 car surge tank steel.

Colorado.—4 cars reinforcing steel, 21 cars bands for wood stave pipe, 3 cars structural steel, 1 car sheet iron.

Washington.—9 cars lumber, 4 cars reinforcing steel.

Oregon.—1 car gate hoists, 8 cars lumber, 1 car cast-iron gates, 66 cars wood staves for pipe.

California.—1 car bituminous enamel, 2 cars reinforceing steel, 7 cars diatomaceous earth, 1 car 75-inch steel pipe, 1 car structural steel.

This illustrates the statement that has often been made that the benefits of Reclamation construction alone are widespread and not confined to the immediate vicinity of the irrigation projects.

Bartlett Dam, Salt River Project, Arizona

Building Bartlett Dam, to impound and control the Verde's flow for the Salt River reclamation project, is no mere matter of running up forms and pouring concrete into them, but involves numerous novel and delicate engineering problems. Some conception of the magnitude of the job, and the difficulties that must be met, was acquired by a party of about 40 farm leaders, officials, and others who visited the site on October 1 as guests of the Water Users' Association.

The guest of honor was John C. Page, Acting Commissioner of Reclamation, who had arrived at Phoenix the day before in the course of a western tour that was to include all his Bureau's projects. He had already looked over Yuma-Gila and found much to praise there; he also expressed himself as more than pleased with the progress and activity apparent on the Verde.

Another special guest was Senator Carl Hayden, whose support and efforts were of so much effect in starting the $6,000,000 program for completing the Salt River project. Bartlett Dam, 25 miles up the Verde from its mouth, is the largest item in that program.

E. C. Koppen, in charge of the Reclamation Bureau's Phoenix office, detailed R. F. Herdman, resident engineer, to explain technical details of the multiple-arch dam, which is to be 270 feet in height and when completed will be the highest of its type in the world.

BARTLETT DAMSITE

LEFT TO RIGHT: LIN B. ORME, PRESIDENT SALT RIVER VALLEY WATER USERS' ASSOCIATION; JOHN C. PAGE, ACTING COMMISSIONER OF RECLAMATION; SENATOR CARL HAYDEN OF ARIZONA.

IDEAL DAM SITE

Herdman pointed out how nature had provided an almost ideal dam site, with rock hills on either side of the river and a pair of stone islands in the channel to make the structure still more solid. Both those hills had men crawling all over them like ants, shooting and scraping off the loose material.

The dam is to consist of ten 50-foot arches, quite thin. Specifications call for a minutely exact job of pouring there. Even more difficulty will be encountered in pouring the massive abutments. These must be made in 40-foot sections with 18-inch joints between them, which will be filled with concrete after the sections have settled.

COOLING METHOD

Because concrete generates heat as it settles and dries, the contract calls for heavy parts of the dam to be poured only in the cool winter months. This is in sharp contrast to practice in northern States, where any kind of outdoor concrete work comes to a halt in winter.

There is a possibility, Herdman said, that in order to expedite matters the contractors may decide to refrigerate their concrete before pouring, and keep right on through the summer. Some of the cooling methods employed at Boulder Dam, where pipes conduct cold water through the concrete, may also be found applicable here. If anything of the kind is done, the Reclamation Bureau must first give its approval.

Power had arrived only a few days before, the dam site having been connected with the water users' system. In the humming big power house, 25-cycle current was being generated into the 60-cycle "juice" necessary for operating high-speed machinery. In the same building the visitors found four 75-horsepower compressors which cut in and go out automatically in accordance with the amount of air being used by the drills.

A new but surprisingly modern construction camp was found half a mile or so below the dam site. The contractors—Barrett, Hilp & Macco Corporation—had completed bunkhouses for 200 men, thought they would need some more. A big dining-hall and clubhouse, garages, warehouses, and miscellaneous buildings had just been placed in service. Construction of 10 houses for the Reclamation Bureau staff, just below the contractors' camp, was scheduled to get under way in a few days.

The only building that deeply interested the visitors, though, was the messhall. There they dived into a bounteous meal of a great variety of well-prepared foods. When assured that it was only the regular dinner served to employees, at least half of the party began pulling wires for Bartlett Dam jobs.—*Arizona Producer, October 15, 1936.*

THE recent Red Cross campaign met with a ready response by the residents of the Carlsbad project.

LUCIA Voorhees of Nisland, Belle Fourche project, won the county gold medal in the 4-H girls record and received a trip to the National 4-H Congress which was held in Chicago on December 1.

AN ADDITIONAL $20,000 has been allotted for completion of the artesian well at the United States experiment farm on the Belle Fourche project. The well is now at the 3300-foot level, and it is expected these funds will enable completion to the 4100-foot depth.

Notes for Contractors

Specification no.	Bid opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
701	*1936* Nov. 2	Columbia Basin, Wash.	Twenty 102-inch Paradox service gates and tweuty 102-inch ring-follower emergency gates.	Hardie Tynes Mfg. Co.	Birmingham, Ala.	$1,341,300.00	Item 1	*1936* Nov. 30
692	Oct. 30	Chain Lakes Storage, Mont.	Construction of Fresno Dam.	Wachter, O'Neill & McGarry Bros.	Bismarck, N. Dak.	980,804.00		Nov. 25
854-D	Nov. 19	Casper-Alcova, Wyo.	Furnishing and installing weatherstripping for Government camp buildings.	The Ideal Metal Weather Strip Co.	Boulder, Colo.	749.80		Nov. 27
852-D	Nov. 16	Boise-Arrowrock, Idaho.	Two 24-inch internal differential control valves.	Johnson City Foundry & Machine Co.	Johnson City, Tenn.	1,930.00		Nov. 25
851-D	Nov. 12	Owyhee, Oreg.-Idaho.	Earthwork and structures, bench laterals.	John Klug	Easton, Wash.	16,972.00		Nov. 30
848-D	Nov. 10	Upper Snake River Storage, Idaho.	Clearing Grassy Lake reservoir site.	Nevada Construction Co.	Nevada, Mo.	24,800.00		Do.
702	Oct. 20	Colorado River, Tex.	Construction of Marshall Ford Dam.	Brown & Root, Inc. McKenzie Construction Co.	Austin, Tex. San Antonio, Tex.	5,781,235.00	Combined bid	Dec. 3
849-D	Nov. 16	Carlsbad, N. Mex.	Two 5-foot by 5-foot high-pressure gate assemblies and two 66-inch welded plate-steel pipes.	Consolidated Steel Corp., Ltd.	Los Angeles, Calif.	17,600.00	Item 1	Dec. 4
				John W. Beam	Denver, Colo.	9,475.00	Item 2	Nov. 28
803-D	Nov. 24	Boulder Canyon, Ariz.-Nev.	Bronze figures, memorial tablet, dadoes, flag box and flagpole collar.	General Bronze Corp.	Loug Island City, N. Y.	22,180.00	Schedule 2	Dec. 3
25531-A		Rio Grande (Caballo Dam), N. Mex.	6,000 barrels of portland cement.	Southwestern Portlaud Cement Co.	El Paso, Tex.	14,040.00	$2.84 per barrel destination less 50 cents discount and sax.	Dec. 5
842-D	Oct. 20	Ogden River, Utah.	Materials for Ogden Canyon siphon.	California Steel Products Co.	San Francisco, Calif.	5,792.00	Item 1	Dec. 10
				American Steel & Wire Co.	Denver, Colo.	1,775.00	Item 2	Dec. 11
				Berkeley Steel Construction Co.	Berkeley, Calif.	6,983.00	Item 3	Do.
847-D	Oct. 30	do.	Construction of Odgen Canyon siphon, South Ogden high-line land.	Dan Teters	Nyssa, Oreg	33,425.00		Dec. 17
803-D	Nov. 24	Boulder Canyon, Ariz.-Nev.	Bronze figures, memorial tablet, dadoes, flag box, and flagpole collar.	General Bronze Corporatiou.	Long Island City, N. Y.	22,180.00	Schedule 2	Dec. 3
855-D	Nov 23	do.	Transformers, air-break switch, relay, aud meter cabinet.	Royal Electric Mfg. Co.	Chicago, Ill.	230.00	Schedule 3 Schedules 1, 2, and 4 (all bids canceled).	Dec. 15

Progress of Investigations of Projects

Colorado-Big Thompson, Colorado.—All field surveys have been completed on the diversion and parties are now working on two alternate canal location alinements to furnish the North Poudre with Colorado River water. A pumping plant is being contemplated along the Poudre Valley Canal about 5 miles from its intake to elevate the water to sufficient height to run into the North Poudre by gravity. The seismographic survey of the easterly 2 miles of the continental tunnel was completed during November and a report submitted covering the items called for in the contract.

Blue River transmountain, Colorado.—Surveys are now under way taking topography of a reservoir site and tunnel portal location near Leal, Colo., on the Williams River and two reservoir sites on Clear Creek, one with a dam site about one-half mile below the junction of the west and south forks and the other just below the junction of Fall River and Clear Creek. Exploration crews are putting in test pits on the Green Mountain dam site to determine the location of bed rock and character of cover.

Western slope, Colorado: (a) *Florida Mesa project.*—Surveys have also been made for the diversion of water from the Florida River to the Pine River with irrigation demand and water supply studies initiated for the latter. No field work was accomplished during November.

(b) *La Plata project.*—Topographic surveys have been completed on the Long Hollow and Upper Hay Gulch reservoir sites and are now under way on the Lower Hay Gulch site.

(c) *Mancos Valley project.*—During November surveys were made of the Jackson Gulch reservoir site. Surveys of ditches in connection with the Weber reservoir site have been completed and are now under way for an inlet ditch from the West Mancos River to the Jackson Gulch Reservoir and its outlet ditch back to the river.

(d) *Paonia project.*—Drilling in connection with the determination of the character and depth of the soils that may be encountered in construction was completed on the Minnesota Creek and Spring Creek dam sites and the diamond-drill equipment then transferred to the Rio Grande joint investigations. Pit work at the Smith Fork dam site is still under way. Additional surveys made at each end of the proposed McClure Pass tunnel did not indicate a shortening nor improvement over the original lines.

(e) *Roan Creek project.*—Exploration of the dam foundations are now being made on the Carr Creek dam site. Pit work is also under way on the sites on Kimball Creek. Summary of the land classification on the project has been completed.

(f) *Silt project.*—Topography has been completed in the canyon of Elk Creek along the ridge separating that creek and West Elk Creek, the Harvey Gap Reservoir and on another site above the

reservoir. Preliminary estimates indicate 3 miles of pipe line, 7 miles of canal, and 3,400 feet of tunnel to supply water from the main Elk to the Silt project through the Harvey Gap Reservoir. The structure inventory on the canal from East Rifle Creek to the reservoir was finished during November. Test pit work on the dam site above Harvey Gap is still in progress.

(g) *Troublesome project.*—Operations were suspended until early spring because of weather conditions.

(h) *West Divide Creek project.*—Test pits and diamond drilling on the Owen dam site have been completed. Estimates are being made on the canal lines on which strip topography was taken.

(i) *Yampa Reservoirs.*—Diamond drilling and digging of test pits were completed, and a tabulation of the land classification and water supply studies are in progress.

Eastern slope, Colorado.—A large number of reservoirs and projects were inspected during the month of November. Preliminary reconnaissance surveys were made of Kiowa, Bijou, and Big Beaver Creeks in Morgan, Washington, and Elbert Counties.

Rio Grande Basin, Colo.-N. Mex.: (a) *Wagon Wheel Gap dam site.*—During the winter months it is planned to do additional drilling.

(b) *Vega-Sylvestre dam site.*—Studies have disclosed the need for additional percolation tests on the foundation materials to be made in the spring.

(c) *Conejos dam site.*—At the present time test pits are being dug on the Mogote site; and further surveys will be made to determine its capacity and the cost of construction.

(d) *San Juan-South Fork transmountain diversion.*—Preliminary estimates of the cost of the entire project and water supply studies are now in progress.

(e) *Animas-Rio Grande transmountain diversion.*—Preliminary estimates of the cost of the project based upon the information so far secured and estimates of the water supply available for diversion are under way.

(f) *Weminuche Pass transmountain diversion.*—Preliminary field surveys have been completed and water supply studies and estimates of cost are in progress.

(g) *San Juan-Chama diversion.*—The final surveys for the canal line disclosed numerous alternatives which offer possibilities for saving in cost of construction and a survey of these alternatives is contemplated next season. Estimates of cost, water-supply studies and the assembly of all available data are now in progress.

(h) *State Line dam site.*—Field work at this site was initiated during the month. Surveys of the reservoir and two proposed dam sites are now in progress and drilling equipment is enroute to the sites.

Boise (Boise-Weiser-Payette), Idaho.—Additional surveys are now in progress on a canal location down the south bank of the Payette River from the proposed Garden Valley Reservoir to Horseshoe Bend and on another from the Boise Diversion Dam, on the Boise River, toward Dry Creek. The Garden Valley to Horseshoe Bend Canal will connect by tunnel with this line at Dry Creek. During November the survey of the Cabarton Reservoir and dam site was completed. Field work on the land classification of about 100,000 acres of land in the Weiser watershed was also completed during the month and work is now under way making a tabulation of the various classifications.

Buffalo Rapids, Mont.—Surveys of the irrigable area and land classification of the project have been completed and a report is being prepared.

Gallatin Valley, Mont.—A preliminary report on a revised study of the water supply and reservoir capacity will be completed at an early date.

Saco Divide, Mont.—Field topographic surveys were completed during June 1936. Work is now confined to the estimates of land classification areas for inclusion in the final report.

Madison River diversion, Montana-Idaho.—The taking of soil samples and making of land classification in the Madison Valley between Three Forks and the Cherry Creek Reservoir site and in the South Bench area were completed during November. An altimeter reconnaissance survey of the Madison Valley indicated that a canal out of the Madison River at the mouth of the West Fork would cover approximately 90,000 acres (gross) of land above the Ennis Reservoir.

Conchas project, New Mexico.—Surveys are now under way on the canal alinement between Tucumcari and Conchas Dam. Existing water-supply records have been assembled and a preliminary report thereon prepared. Preparation is being made for a survey of the irrigable lands and a land classification.

Deschutes, Oreg.—An estimate of an alternate north-unit canal line diverting near Cline Falls has been completed and designs are being prepared. Water-supply studies from Lake Creek and Suttles Lake storage and the land classification of the Plainview Tract were completed. Surveys are now under way for a land classification of the South Unit and on a canal location with a diversion at the Arnold Canal heading.

Black Hills, S. Dak.—The topographic mapping of the irrigable areas on the Horse Camp project near Hot Springs has been completed. Water-supply studies are being made of the Angostura project in connection with the report on these investigations.

Utah: (a) *Blue Bench project.*—Field surveys were begun on these investigations about the middle of November to determine the possibility of diverting water from Rock Creek to both the upper and lower Blue Benches and from the Duchesne River to the lower Blue Bench.

(b) *Currant Creek Canal.*—Water-supply studies and surveys are being made to determine the quantity of water available for diversion to the Strawberry Reservoir.

(c) *Dixie project.*—A final report is being prepared.

(d) *Gooseberry project.*—Additional data on water supply have become available since the completion of a report on these investigations in 1934 and studies are now being made to determine the yield of the Gooseberry Reservoir during a low run-off such as 1931 to 1934.

(e) *Ouray project.*—Stream-discharge observations extending over the past 2 years, water-supply studies, land classification, and canal surveys have been completed.

(f) *Salt Lake metropolitan water district aqueduct.*—Surveys have been made of several alternate high- and low-elevation alinements for the construction of a 54- and 72-inch aqueduct.

Colorado River Basin.—Classification and maps are completed of lands on the Lower Gila and along the Colorado River below Boulder Dam in Arizona; on the Yampa and Gunnison Rivers and the San Juan Basin in Colorado; in the Las Vegas and Upper Meadow Valley Wash areas in Nevada, and in the San Juan Basin in New Mexico. Field work of classifying and mapping large areas of lands in Utah have been completed.

Island of Molokai, Hawaii.—Trails are being cut into various watersheds of the Island of Molokai, and as each is completed, the stream flow is analyzed and compared with previous records.

Grand Coulee Dam Attracts Visitors

A large party of delegates en route to the eighteenth convention of the American Farm Bureau Federation at Pasadena visited Grand Coulee Dam December 4. The guests numbered 260 and represented 173 localities in 12 States, mostly from the Middle Western States, but Vermont, Alabama, Tennessee, Virginia, and West Virginia were also represented. There were 104 ladies among the guests.

The visitors were entertained by talks at the west side and the east side Vista houses, by Construction Engineer Banks, on reclamation and on the Columbia Basin project, and enjoyed a sumptuous dinner at the contractors' messhall.

C. C. C. Accomplishments on Reclamation Projects

By Alfred R. Golzé, Supervising Engineer, E. C. W.

SCATTERED over 23 reclamation projects in 14 States, 34 C. C. C. camps are accomplishing many varied and useful types of work as a part of a general rehabilitation program.

Much of the work of the C. C. C. enrollees on the reclamation projects is of an unspectacular nature concerned with a program for the permanent improvement of existing water-control structures and irrigation distribution systems. A number of construction features are in progress of sufficient importance and interest to warrant their description in some detail, a few of which are outlined herein.

CONCRETE LINING OF CANALS

On the North Platte project, in western Nebraska, a program of lining canals and laterals with concrete is in progress by C. C. C. men from Camp BR–1 at Lake Minatare, and BR 53 at Mitchell. On this project irrigation waterways are lined with reinforced concrete to conserve water by elimination of seepage losses and by prevention of plant growth along the banks. More efficient distribution of water to farms is being accomplished by the construction of straight laterals to replace meandering and contour laterals that crossed and recrossed farm-unit lines, preventing full utilization of the land. The new straight laterals with a required steep grade are also concrete lined to prevent the erosion which would occur from the increased velocity of the flowing water. On the facing page are two recent photographs illustrating concrete lining, 53,000 square yards of which have been completed by the C. C. C. enrollees on the North Platte project in the 2 years that they have been at work.

CONSTRUCTION OF DAMS

In eastern Utah there is under construction by C. C. C. men from Camp BR–11 at Bridgeland, the Midview Reservoir, of 5,000 acre-feet capacity, which will be part of the supplemental water-supply system for the Moon Lake project. Water will be diverted from the Duchesne River and stored in this reservoir, which will be formed by an earthfill dam now under construction at its east end having a volume of 100,000 cubic yards, a height of 48 feet, and a length of 670 feet. An earth dike 16 feet high and 1,900 feet long has been completed at the west end of the reservoir. A construction view of the Midview Dam appears on the opposite page, showing the earth embankment about level with the original ground surface and a portion of the concrete core wall.

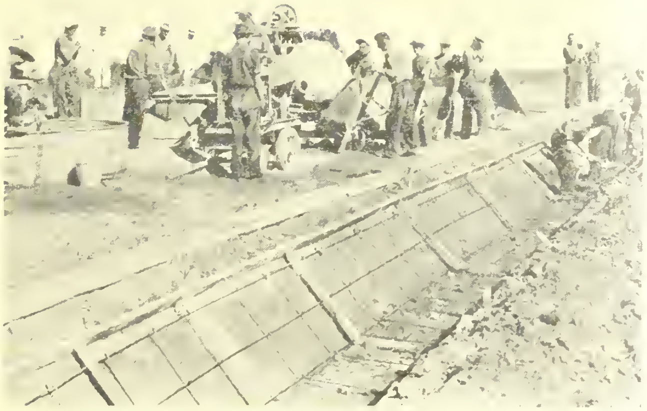
A similar reservoir is under construction by E. C. W. forces on the Huntley project in south central Montana. On the Reservoir Line Canal, C. C. C. enrollees are constructing the Anita Dam to provide an equalizing reservoir which will reduce the required pumping time for the auxiliary plant at Ballantine. This dam, which will create a 450-acre-foot reservoir, will be 42 feet high, 1,000 feet long, and of earthfill construction. Another major E. C. W. undertaking on this same project is the construction of jetties along the Yellowstone River to eliminate serious erosion of farm lands from flood waters. At several locations, flood waters of this river have reduced by erosion, farm units to one-sixth their former size, and the work of the C. C. C. men will entirely eliminate this menace.

The St. Mary storage unit furnishes water for the Milk River project in north central Montana through a canal system originating in the western part of the State at the eastern portal of Glacier National Park. Not far east of the Park this canal system crosses the valley of the St. Mary River through two large 90-inch steel pipe siphons. One of these pipe lines, when originally built, was buried underground to avoid the expense of placing it on piers. Moisture in the soil has attacked the pipe and to avert serious rust damage it has become essential to excavate the line and place it on concrete piers, a project well suited for C. C. C. enrollees. Because of the nature of this work it can only be prosecuted when the ground is frost free and the picture opposite shows C. C. C. men from Camp BR–32 at Babb at work on the pipe line during the past summer.

In New Mexico, summer cloudbursts are a frequent occurrence, the rapid run-off resulting in filling the narrow draws of the region along the lower Rio Grande River with flood waters. These waters, rushing down arroyos to the river, frequently carry much silt and debris into or wash out entirely the irrigation canals and farm lands below their mouths adjacent to the river. On the Rio Grande project this problem is being met by the construction, with C. C. C. men, of large erosion and flood control dams, permanently built across the draws to retain silt and reduce the force of the sporadic floods. The Apache Dam in the Picacho Arroyo, built by Camp BR–39 of Las Cruces, N. Mex., is a typical example of this fine type of soil and water conservation. A photograph showing the downstream face of the 40 feet high masonry type Apache Dam appears on the facing page.

RODENT CONTROL

Rodent control is an undertaking of major importance to many reclamation projects. The value of this work in reducing canal breaks and crop damage is highly appreciated by the residents of our irrigated lands. C. C. C. men are well adapted to this type of activity which can be performed by small crews as a work project incident to the large construction features requiring considerable labor and equipment. This work, which is done in cooperation with the Bureau of Biological Survey, may be accomplished either by trapping, poisoning, or both.

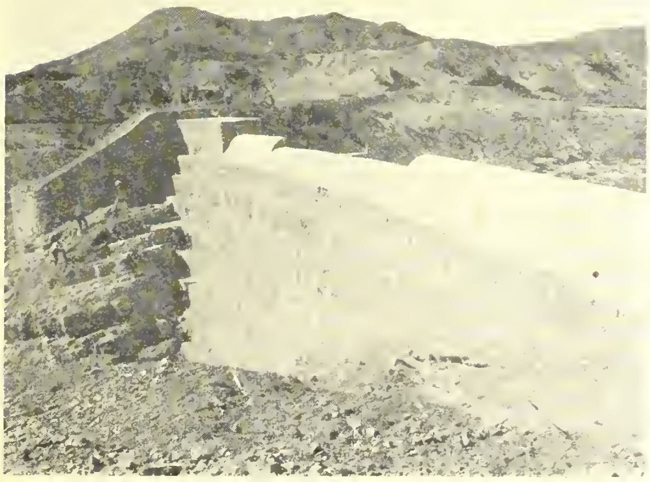


C. C. C. ENROLLEES CONCRETE LINING IRRIGATION LATERAL CAMP BR-53
NORTH PLATTE PROJECT NEBRASKA

COMPLETED CONCRETE LINED IRRIGATION CANAL CAMP BR-1
NORTH PLATTE PROJECT NEBRASKA

APACHE DAM BUILT BY C C C ENROLLEES CAMP BR-39
RIO GRANDE PROJECT NEW MEXICO

C C C ENROLLEES EXCAVATING STEEL PIPE SYPHON CAMP BR 32
ST MARY STORAGE UNIT, MONTANA



MIDVIEW DAM UNDER CONSTRUCTION BY CCC CAMP BR-11
MOON LAKE PROJECT UTAH

TYPICAL RODENT CONTROL CREW OF CCC ENROLLEES

Fifteen projects have been benefited by the accomplishments of the C. C. C. rodent control crews which have worked over 700,000 acres since the inauguration of E. C. W. on Reclamation lands in the summer of 1934. A photograph of a C. C. C. rodent control crew appears on the page of E. C. W. photographs in this issue.

Articles on Irrigation and Related Subjects

All-American Canal:

Excavation of All-American Canal nearly 74 percent completed. Southwest Builder and Contractor, Nov. 20, 1936, v. 88, p. 15.

Arkansas River:

Arkansas River and tributaries. War Department, Report on Navigation, Power, Flood Control, and Irrigation, under Doc. 308, vol. 1 of 3, H. Doc. 308, 74th Cong. 620 pp.

Boulder Dam Power:

Circuit breakers for Boulder Dam line. (Discussion of paper by H. M. Wilcox and W. M. Leeds, in June 1936 issue.) Electrical Engineering, Nov. 1936, v. 55, no. 11, pp. 1250-1252.

Reprint of a Pictorial History. Electrical West, October 1936, 32 pages, numerous illustrations.

Boulder Dam-Los Angeles Power System, illus., Electric Journal, Nov. 1933, v. 33, no. 11, pp. 476-506. Boulder power number.

Boulder Dam Service Bureau, Construction of Boulder Dam, illus., 48 pp. Small size, 5 by 6¾ inches. Price 25 cents, Boulder City, Nevada.

Grand Coulee Dam:

Use of frozen earth dam successful at Grand Coulee, illus., Western Const. News, November 1936, v. 11, no. 11, p. 364.

Freeze toe of landslide at Grand Coulee Dam to stop progress, Southwest Builder and Contractor, November 27, 1936, v. 88, p. 11.

M. W. A. K. starts diversion of Columbia, illus., Pacific Builder and Engineer, December 5, 1936, v. 42, p. 32.

Hill, L. C.:

Biography, candidate Pres. A. S. C. E., Civil Engineering, December, 1936, v. 6. p. 827 (with portrait).

Ickes, Hon. Harold L.:

Ickes proud of speed in paying estimates, The Constructor, November 1936, v 18, no. 11, p. 25.

Report of the Secretary of the Interior for Fiscal Year ending June 30, 1936; 436 pages. Bureau of Reclamation, pp. 53-97.

Jones, P. A., and V. L. Minear:

Grouting the foundations of Boulder Dam, illus., Civil Engineering, December 1936, v. 6, pp. 810-814.

Keener, K. B.:

K. B. Keener, named head of Bureau of Reclamation dam design (portrait), Western Const. News, November 1936, v. 11, p. 373.

Klamath project:

Klamath Federal Reclamation project, Oregon-California, illus., 20 pp. Available for free distribution. 1936.

Mead, Lake (Lake Mead):

An artificial lake in Mojave County, Ariz., and Clark County, Nev., formed by damming Colorado River in upper Black Canyon. Named in honor of Dr. Elwood Mead (b. Jan. 16, 1858, d. Jan. 26, 1936), Commissioner, Bureau of Reclamation, 1924-36, under whose supervision the dam that impounds the lake was built. Decisions Geographic Board, July 1, 1935, to June 30, 1936, p. 30.

Olson, N. T.:

How to get accurate topography in difficult country described (Seminoe Dam). Southwest Builder and Contractor, November 27, 1936, v. 88, p. 10.

Page, John C.:

Creation of Homes objective of Reclamation Bureau, Chief says: address at Spokane. Southwest Builder and Contractor, December 4, 1936, v. 88, no. 23, p. 11-12 and 25.

Biography with portrait. Pacific Builder and Engineer, December 5, 1936, v. 42, p. 21.

Reclamation and Industry:

Reclamation as an aid to industrial and agricultural balance, maps and tables, E. P. Goodrich and Orin D. Davis. Proc. A. S. C. E., November 1936, v. 62, pp. 1377-1408.

Red River:

Report on Red River, La., Ark., Okla., and Texas, by the Chief of Engineers, War Dept. under provision of H. Doc. 308, 69-1, January 3, 1936, plans and maps, H. Doc. 378, 74-2, 833 pages.

Renner, F. G.:

Conditions influencing erosion on the Boise River watershed, illus. Dept. of Agriculture Technical Bulletin No. 528, October 1936, 32 pages.

Silverman, I. K.

Stresses around circular holes in dams and buttresses. Proc. A. S. C. E., November 1936, v. 62, no. 9, pp. 1361-1376.

Voetsch, Chas. and M. H. Fresen:

Economic diameter of steel penstocks. Proc. A. S. C. E., November 1936, v. 62, no. 9, pp. 1343-1359.

Worden, O. S.:

Statement, as Pres. of the Nat'l Rec. Asso. before Senate Com. on Irrig. & Rec., February 1, 1936, 10 pp.

Reclamation is cornerstone of our agriculture. Montana Farmer, October 1, 1936, v. 24, no. 3, pp. 6 and 27. (Full storage will solve relief problems.)

Wright, C. A.:

Experimental study of the scour of a sandy river bed by clear and by muddy water, illus. Bureau of Standards Research Paper #907 Reprint from Journal of Research Aug. 1936, v. 17, pp. 193-206. (Experiments in connection with design Boulder Dam.)

Yakima Valley:

Reclamation: A sound national policy, an inquiry into the effects of irrigation development on local, state, and national economy as demonstrated by the Yakima Valley and other irrigated areas in Washington, illus., B. H. Kizer, Chairman, Washington State Planning Council, June 1936, 60 pages, 8½ by 11 inches.

Yuma Project:

Yuma: Federal Reclamation Project, illus., 1936, 28 pp. (#82929-36) Settlement pamphlet 6 by 9 inches.

TECHNICAL MEMORANDA

Technical memoranda on engineering subjects recently issued are as follows:

530. Rock temperatures in Black Canyon at Boulder Dam site, J. G. Ross, July 31, 1936, 63 pages, including charts, price $2.45.

531. Rational design of pile foundations, C. P. Vetter, August 24, 1936, 29 pages, including charts, price $1.00.

532. Sandri, Kind, Hoffman, Honigmann, and Spindel on "Special Cements", condensed from the German and Italian for the Second Congress on Large Dams, F. L. Panuzio, E. F. Wilsey, and D. P. Barnes, August 26, 1936, 45 pages, price 50 cents.

533. Laboratory procedure in testing earth dam materials, by personnel of the Earth Dam Materials Testing Laboratory, Sept. 1, 1936, 73 pages, appendix with 33 figures, price $7.00.

534. Stresses in thin conical shells of constant thickness, E. D. Rainville, Sept. 21, 1936, 7 pages, price 25¢.

535. Field methods for pressure grouting foundations of Boulder Dam and appurtenant structures, illus., V. L. Mincar, Oct. 1, 1936, 58 pages, price $3.10.

536. Velocity distributions and the hydraulic design of side channel intakes and spillways, and tailraces (contribution to the study of flowing water) by Henry Favre, Doctor of Science. Translated from French by D. C. McConaughy, Oct. 12, 1936, 55 pages, including charts, price $1.10.

537. Trial-load twist analysis of stresses in the high Grand Coulee Dam, joints ungrouted, F. D. Montgomery, Oct. 15, 1936, 15 pages, charts, price 50 cents.

538. Reservoir temperature studies with special reference to Mead Lake, W. E. Green, Nov. 11, 1936, 63 pages, charts, price $2.35.

539. Analysis of the arches of a multiple arch dam, R. G. Rolin, Nov. 10, 1936, 34 pages, figures, price $1.00.

540. Charts and methods of making computations of cooling of concrete in Grand Coulee Dam, Clarence Rawhouser, Elmer L. Chapman and Chas. B. Spicer, Nov. 17, 1936, 14 pages, figures, price 40 cents.

Application for these publications should be made to Chief Engineer, Bureau of Reclamation, United States Custom House, Denver, Colo.

Excerpts from November Project Reports

Pine River.—All crops have been harvested, and with the exception of alfalfa have been sold at a favorable price. Prices were exceptionally favorable for all commodities.

Sun River.—Livestock is generally in good condition with favorable weather making it easy on feed piles.

Moon Lake.—Sheep and livestock from the ranges are in very good condition. Considerable winter feeding will be done on the project lands this season. Marketing conditions for dairy and poultry products remained very good. More than the usual number of turkeys were sold this year.

Riverton.—The harvesting of crops is now complete. Excellent yields of farm produce combined with good prices have gone far to make the past season one of success for most of the farmers on the project. Prices for farm produce remain good with no indication that they will drop.

Yuma.—The local lettuce deal began November 23, when L. M. McLaren Co. shipped three cars. This year's crop is excellent quality and was maturing rapidly at the close of the month.

Yuma Auxiliary.—Picking of the season's grapefruit continued throughout the month. The grade and quality of the fruit is good for this time of the year. The quality is better than average.

Klamath.—Livestock is in excellent shape. Owing to mild weather there has been little, if any, feeding of livestock on project farms.

Yakima.—An all-time record for sugar beet production in the United States was set in the Yakima Valley this year, according to R. L. Howard, State manager of the Utah-Idaho Sugar Co. An average of 18 tons per acre was secured on 971.4 acres. Twenty-six growers, representing 29 percent of the total acreage in the district, have been announced as members in a "twenty-ton per acre" club. The highest production reported was 28.17 tons per acre. An initial payment of $5.25 per ton to 109 growers in the valley has been announced by the sugar company for the 1936 crop. This initial payment is $1 per ton more than was credited to growers' accounts last year. Additional payments will be made as the sugar from the beets is sold.

A recent check on apple production shows that this year's crop is larger by 1,000 to 1,500 cars than indicated by early estimates. Warehouse holdings and shipments already made indicate a crop of 11 000 cars. The favorable late growing season which resulted in larger apples is given as the reason for the increase in tonnage to be marketed.

Settlement Activity at Vale

A number of inquiries were received and a number of prospective settlers called at the Vale project office relative to lands on the Willow Creek unit during the month of November. Several sales were reported. Twenty-two out of the 27 public land farm units thrown open to entry on May 14 last have been filed on. The applicants for the five remaining units have been notified of their selection.

Reclamation Association to Meet

The annual meeting of the Wyoming Reclamation Association will be held January 20 and 21 in the Chamber of Commerce building at Cheyenne.

Among speakers scheduled for the program are Governor Leslie A. Miller, Perry W. Jenkins, State Engineer John Quinn, Will Metz, WPA director, Charles B. Stafford, secretary of the association and others.—*The Goshen News, Torrington, Wyoming.*

Reclamation Christmas Party

On December 24 the Washington office of the Bureau of Reclamation held a Christmas party for its employees at which the Reclamation children were honor guests. The children attending the party included:

Billie Baden, Caroline, Jack, Lee, Patsy, and Virginia Barrett, Peggy Dey, Joan Feast, Joan Giles, Donald Golladay, Mary Patsy Jackson, Audrey and Dorothy Kubach, Paul Menehan, Mildred Page, Verna Jean Patrick, Marilyn Sumner, Janie, Warne, and Elizabeth Wigglesworth. Everett T. Giles, of the Engineering Division, made an excellent Santa Claus and presented each child with a gift.

EMPLOYMENT conditions on the Provo River and Sanpete projects remained improved, with numerous small building and construction programs in progress.

LARGE numbers of substantial improvements, including residences, business buildings and other structures, are being built on the Minidoka project. This activity is especially noticeable in Burley and Rupert, although it is also evident on the farms.

INQUIRIES continue to come from qualified settlers of homesteads lands and farmers interested in moving on to irrigated tracts on the Sun River project.

THE United States Reemployment Service on the Carlsbad project has been active in placing the unemployed on local and various construction jobs in the vicinity.

Reclamation Organization Activities and Project Visitors

R. F. Walter, chief engineer; J. L. Savage, chief designing engineer; J. J. Hammond, senior engineer; and C. H. Paul, consulting engineer, were recent official visitors on the Boise project, Idaho. Mr. Walter, in company with A. F. Darland, field engineer at Coulee Dam, also visited and inspected the Yakima project and the Roza division.

Ben D. Glaha, photographer on the Central Valley project, who was called to the Washington office by the Division of Motion Pictures to assist in reediting the Boulder Dam film, left for the West December 31.

Charles A. Burns, construction engineer on the Pine River Dam project, spent several days in Denver during the month of November.

B. E. Stoutemyer, district counsel, Portland, Oreg., arrived in Washington on January 3, where he will spend a week or more in connection with legal matters affecting the Yakima and Minidoka projects.

E. V. Chettle, senior engineering draftsman; John H. Gibson, inspector; Kenneth Abplanalp, senior engineering draftsman; Jack H. Craven, instrumentman; Archie K. Hill, engineering draftsman; and Clayton O. Crane, levelman, have been transferred from the Ogden River project to the Denver office.

Death of Joseph C. Gawler

Joseph C. Gawler, for many years identified with the Yakima project office, passed away at his home in Yakima, Wash., on December 15 last. His death occurred after a brief illness which culminated in pneumonia.

A further statement concerning Mr. Gawler's life and connection with the bureau will be carried in our next issue.

L. C. Hill, of Los Angeles, Lester S. Reedy, of San Francisco, and John P. Buwalda, geologist of Pasadena, composing a board of consulting engineers for the city of San Diego, accompanied by Fred D. Pyle, hydraulic engineer for San Diego, visited the All-American Canal project and inspected a portion of the construction work on November 10.

Among the callers in the Washington office during Christmas week were the following: Hugh T. Cuthbert, C. P. A., member American Institute of Accountants; and R. K. Wood and I. E. Moore, members of the board of governors, Salt River Valley Water Users' Association, all of Phoenix, Ariz.

W. E. Anderson, one of the United States Commissioners on the International Water Commission, United States and Mexico, who served with the late Dr. Elwood Mead, Commissioner, and Miss Mae A. Schnurr, Assistant to the Commissioner, called at the Washington office on December 22.

As the Era goes to press word has been received that Mrs. F. F. Weymouth, wife of the former Chief Engineer, Bureau of Reclamation, died suddenly on January 2, in New Orleans, while en route to Washington, D. C., with Mr. Weymouth.

Assistant Chief Accountant Gains Merited Recognition

Herbert R. Pasewalk, for the past 6 years assistant chief accountant, Bureau of Reclamation, has received an appointment as senior investigator, General Accounting Office, Washington, D. C. This recognition of Mr. Pasewalk's experience and ability by the Federal Government's major accounting bureau is hailed as a well-merited promotion in his chosen line of endeavor.

The General Accounting Office is coordinate with the Office of the Comptroller General of the United States, which is charged by law with the settlement and adjustment, independent of the executive departments, of all accounts in which the Government is concerned. Mr. Pasewalk's new duties will require unusual ability and efficiency. These qualities he has developed to a marked degree during his 22 years of service in the Bureau of Reclamation, and particularly so for the past 6 years while in the Washington office.

The Accounting Division of the Bureau of Reclamation is generally recognized in accounting circles of the Federal Government as superior in exactness and precision. Its personnel is carefully selected and is highly trained. Mr.

Pasewalk's advancement to the position of assistant chief accountant was in recognition of his efficient service in his special line of work. He has been employed in the Bureau continuously since June 16, 1914, having been first assigned to the Umatilla project, Oregon. Two years later he was transferred to the Strawberry Valley project, Utah, where he rose progressively to the position of chief clerk. When the project was incorporated by the Water Users' Association he was designated Chief Clerk on the Yuma project, Arizona, which position he held until his assignment as assistant chief accountant in the Washington office.

In releasing Mr. Pasewalk to Washington, R. M. Priest, project superintendent, said: "I regret losing Mr. Pasewalk, but am glad to see him advance. He is an exceptional man and will prove satisfactory in his new assignment. Under the direction of Mr. Pasewalk the Yuma project clerical and accounting work have been handled very efficiently. Since his assignment to the project in 1927 he has materially reduced the clerical operating costs through the reduction of forces and the application of the latest improved methods, equipment, and surroundings."

In addition to his natural ability and professional qualifications Mr. Pasewalk is a true son of the West. His honesty and frankness are outstanding attributes. These qualities have endeared him to all his associates, by whom his future course will be followed with keen interest.

U. S. GOVERNMENT PRINTING OFFICE. 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page,** Acting Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr. of Operation and Maintenance; John C. Page, Chief Engineering Division; A. R. Golzé, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel, ! R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative L. S. Davis, Engineer, E. C. W. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev.	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Ft. Sumner, N. Mex.	Wilfred W. Baker	Engineer		do	Do.
Casper Alcova	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voyen	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer		do	Do.
Frenchtown	Missoula, Mont.	I. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev.	L. J. Foster	Constr. engr.	George B. Suow	do	Do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont.	H. V. Hubbell	Constr. engr.	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin [2]	do	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	F. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam [3]	Parker Dam, Calif.	E. A. Moritz	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Pine River Dam	Bayfield, Colo.	Charles A. Burns	do		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex.	L. R. Fiock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	S. F. Crecelius	Constr. engr.		do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. C. Koppen	Constr. engr.	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do	do	Do.
Stanfield	Boise, Idaho	R. J. Newell	do	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields division	Fairfield, Mont.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Reno, Nev.	L. J. Foster	Constr. engr.	Geo. B. Snow	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do	do	Do.
Upper Snake River Storage [4]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash.	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza div.	do	Chas. E. Crownover	Constr. engr.	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting. [3] Non-Federal. [4] Island Park and Grassy Lake dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormich	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A.	Wellsville, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr.	President	Dorothy Eyers	Do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook division [1]	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do	Mary Harrach	Torrington.
Northport division	Northport irrigation district	Northport, Nebr.	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	Superintendent	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	do	F. C. Henshaw	Phoenix.
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Geo. W. Atkins	Powell.
Frannie division	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotegut	President	E. G. Breeze	Payson
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West division	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager	G. L. Sterling	Ellensburg

[1] Operated by 5 irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo.	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo.	Frank C. Merriell	Do.
Black Hills	Rapid City, S. Dak.	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	Denver, Colo.	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Engineer.
Buffalo Rapids	Miles City, Mont.	J. A. Keimig	Assistant Engineer.

SALLIE A. B. COE, *Editor.*

THROUGHOUT THE DROUGHT-STRICKEN WEST, IRRIGATION PROJECTS STAND AS THEY HAVE IN THE PAST AS ONE OF THE CHIEF SUPPORTS FOR THE NATION'S LIVESTOCK INDUSTRY. FORAGE AND HAY GROWN UNDER THE IRRIGATION CANALS HAVE PREVENTED COMPLETE DEMORALIZATION OF THE LIVESTOCK INDUSTRIES OF WIDE REGIONS SURROUNDING THE PROJECTS. HERE IS A FLOCK OF SHEEP BEING TRAILED INTO THE MILK RIVER FEDERAL RECLAMATION PROJECT IN MONTANA FROM THE DUST-DRY PUBLIC RANGE.

THE
RECLAMATION ERA

VOL. 27, NO. 2 FEBRUARY 1937

JOHN C. PAGE
NEWLY APPOINTED COMMISSIONER OF RECLAMATION

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THE
RECLAMATION ERA

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HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Commissioner, Bureau of Reclamation

Vol. 27, No. 2

FEBRUARY 1937

President Roosevelt Appoints John C. Page Commissioner of Reclamation

JOHN C. PAGE, appointed Commissioner of the Bureau of Reclamation by the President on January 25, is a westerner intimately acquainted with the problems of conservation and use of the meager water supply of the semiarid and arid States.

Born in Syracuse, Nebr., October 12, 1887, Mr. Page entered the Reclamation Service soon after completing his engineering education. For more than 25 years, he has worked in the Bureau, first on jobs such as would be assigned to any young engineer, then as supervisor of the operation of a Federal irrigation project, and later as chief administrative assistant in the construction of Boulder Dam, the greatest structure built by the Bureau and the highest dam in the world.

The late Dr. Elwood Mead, long-time Commissioner of Reclamation, called Mr. Page to Washington October 1, 1935, to assist him in the Commissioner's office as head of the engineering division. Shortly after the death of Dr. Mead last January, Secretary of the Interior Harold L. Ickes appointed Mr. Page, the man Dr. Mead had chosen as his understudy, as temporary head of the Bureau of Reclamation with the title of Acting Commissioner.

The record Mr. Page has made as administrator of the far-flung activities of the Bureau of Reclamation during the 10 months he has served as Acting Commissioner has given the various officials and citizens in the vast area in which the Bureau of Reclamation operates an opportunity to recognize his ability and judge his capacity to execute policies of vital import to the West and the Nation.

He was appointed by Secretary Ickes as a member of the water resources committee of the National Resources Committee, and last summer he was chosen as a member of the President's Great Plains Drought Area Committee.

In addition to his engineering experience Mr. Page has been a farmer, both in humid and arid climates. Between 1909 and 1911 he operated an irrigated farm in Colorado.

The extraordinarily varied experience Mr. Page has gained in the field of reclamation through the diversity of work assigned to him in the Bureau makes him well qualified to head the organization he has served so well.

The new Commissioner is a civil-service employee of the Bureau of Reclamation.

On January 26 Commissioner Page was the recipient of a floral tribute and felicitations from the entire staff of the Bureau, which gathered in his office. He addressed his associates expressing his appreciation of the honor conferred by the President, and solicited the cooperation of each and every member of the staff, stating:

"It is one thing to be appointed Commissioner of Reclamation but it is another thing to carry on effectively thereafter. To do this I know I must have your help. I know I can depend on this."

A number of visitors from the Western States were in Washington and extended congratulations to the new Commissioner.

It is a coincidence that Mr. Page should be sworn in as successor to Dr. Elwood Mead, former Commissioner of Reclamatian, on the first anniversary of his death.

As Acting Commissioner he has carried on the policies of Dr. Mead, the grand old man of reclamation, and aggressively pushed forward the gigantic construction program in which the Bureau is engaged.

IMPORTANCE OF RECLAMATION

The Bureau of Reclamation, which Mr. Page now heads, operates in 17 Western States in that arid and semiarid region lying west of the one hundredth meridian and comprising about one-third of the territory of continental United States. The Bureau has more than a score of projects in construction, nearly 40 in operation, and has been for a generation the chief agency engaged in the conservation of the water resources of the arid but potentially productive West.

The purpose of the Bureau, as stated recently by Mr. Page, is to strengthen through conservation of water—the section's most vital resource—the agricultural foundation for the civilization which is so rapidly developing in those areas, and foster its wise use in the creation of new opportunities, new homes, and new communities.

MR. PAGE WELL FITTED FOR COMMISSIONERSHIP

Mr. Page graduated in 1908 from the University of Nebraska, receiving a degree of bachelor of science in civil engineering. He continued his studies for 18 months at Cornell University, where he specialized in hydraulics and civil engineering.

He first entered the employ of the Reclamation Service, as it was then known, on October 1, 1909, as a topographer in the location of canals in Colorado. He left the service briefly to serve as assistant to the city engineer of Grand Junction, Colo., but reentered it July 1, 1911 to assist in the construction of the Grand Valley Federal reclamation project near Grand Junction. Since that time he has been continuously in the service of the Bureau of Reclamation.

In 1925 Mr. Page became superintendent of the Grand Valley project, a position in which he obtained much practical experience in the problems connected with settlement and operation of completed projects. He was transferred from this position September 12, 1930, to the Boulder Canyon project. He served throughout the period of construction of Boulder Dam as office engineer, the chief administrative assistant.

Mr. Page is a member of the American Society of Civil Engineers. He is married and has two daughters.

Boulder Dam Plays Its Part in Reclamation

By Walker R. Young, Construction Engineer, Bureau of Reclamation

BOULDER DAM is a reality. Today its massive structure rises to stop the gap between the walls of black Canyon. Where the muddy Colorado River once flowed unrestricted, there is a clear reservoir now containing 10,000,000 acre-feet of stored water. Electric energy generated at the power plant is being delivered to the Pacific Coast. Many have followed the construction of this project, but few are familiar with its purposes or appreciate the benefits that are certain to result. It may be appropriate, therefore, to review these briefly.

To grasp the significance of Boulder Dam, one must understand the relation of the Colorado River to the settlement and economic development of the 244,000 square miles of the drainage basin, comprising parts of seven States and a very small part of Mexico. Eighty percent of the flow originates in the lofty snow-capped mountains of the two States of Wyoming and Colorado, ranging upward to elevations in excess of 14,000 feet above sea level. This is the source of the turbulent summer floods resulting from the melting of deeply packed snow and ice.

Through its lower course, the Colorado flows across the hottest and dryest part of the United States, finally discharging into the northerly tip of the Gulf of California. There are places where the annual precipitation is only 3 inches, where no rain falls in summer, and where the existence of civilized life depends on ability to utilize the water of this river.

Unfortunately, floods and the silt-carrying proclivity of the Colorado River introduced serious problems for those making use of the land and water. To protect those lands lying below the elevation of the river, levees were required to confine the river to its channel. Each year the river, with its heavily silt-laden floods, debauched on the lower valleys, tearing at the levees in its mad effort to find means of escape to lower lying lands. Man retaliated by building his levees higher and stronger.

Failing to escape the levees, the river deposited the silt in its own channel in an effort to lift itself over the levees—to attack and destroy what man had been able to establish. The fight went on. Levees were breached; fields were destroyed; irrigation ditches were filled with silt; levees were raised; ditches were cleaned; crops were replanted; and new basins were developed in which the river could deposit its silt, until finally the defensive measures became so costly as to be oppressive. The river provided an ever-present menace and man was brought to realize that the only possible way to win his fight against it was to put it under control and thereafter make it his servant.

Without regulation, the river had little value to the lower basin area. The quick run-off and the absence of summer rains made any large irrigation development, or any large power development, uncertain and unprofitable, and the river could not be depended upon as a source of water supply for cities. Without storage facilities, further development by irrigation was not feasible, and in fact more land had already been canalized than could be irrigated by the natural flow of the river during periods of low discharge. Regulation of flood waters by storage was therefore seen to be the basis of all safe and profitable development.

RIVER REGULATION

Regulation of the Colorado River requires a reservoir, or reservoirs, with sufficient capacity to equalize the variations of flow between seasons, and also the variations in discharge over a long period of time. Such regulation is imperative because, at present, nearly 800,000 acres of irrigated land and the homes of 100,000 people are dependent on diversions made in the vicinity of Yuma, and because of the rapid extension of irrigation in the Imperial Valley in California and in southwestern Arizona. These factors have created a demand for water greater than the low-water flow of the river.

This demand for a secure water supply and protection against flood menace compelled the attention of the Federal Government and resulted in the construction of Boulder Dam. Thus not only the main objectives of flood control and irrigation are realized, but also other advantages accrue. Among these are the reduced cost of removing silt and the increased supply of pure water for the growing population of the cities and towns of southern California and the orchards and gardens that surround them.

DIVISION OF WATER

The Bureau of Reclamation since its inception in 1902 has studied the Colorado and has investigated it intensively since 1920. During the time the engineering features were being investigated, thought was also being given to the legal phases, with particular reference to an equitable division of the water. In litigation it had been assumed that the river and its tributaries carried annually an average of about 18,000,000 acre-feet of water; that about half of this had been put to beneficial consumptive use; and that the remainder was flood water for the use of which storage facilities were necessary.

It was inevitable that on so extensive a river system, flowing through arid country, the seven States involved should disagree over their respective water rights. In 1922, when they undertook to settle these problems, it was estimated that about 2,127,000 acres of irrigable land lay in the lower basin and about 4,000,000 in the upper basin, and that of these areas, the lower basin contained approximately 1,165,000 acres awaiting development and the upper basin about 2,500,000 acres.

For a number of years prior to 1922 the lower basin, growing more rapidly in population than the upper area, had pressed for development of the lower Colorado River, and the upper area had objected. Two lower-basin projects particularly were urged. One was the development of the Imperial Valley, lying below the level of the river, which needed relief from floods through the erection of a flood-control dam, and which also needed an all-American water supply in lieu of its existing canal, which passed through, and was largely controlled by Mexico. The second project, presented by interests of the California coastal plain, called for the erection of a power dam at Boulder Canyon or Black Canyon.

ECONOMIC ADVANTAGES

The first effect of the project was to aid in solving the problem of unemployment caused by the depression. In April 1931 the first construction work was started in Black Canyon. As the job progressed, more and more men were hired; the new community of Boulder City was established; and materials and supplies started pouring into the project over the newly built highways and railroads. The number of men at work on construction increased to a maximum of 5,250. The project's monthly pay rolls grew to a maximum of $743,000, and millions of dollars started flowing through the channels of trade, bringing in foodstuffs, steel, machinery, cement, and other construction supplies and equipment.

During the construction period the average number of men employed at the damsite was approximately 4,000. Statistical data indicate that for every 10 men engaged in construction, 18 are employed in supplying materials. Thus, an average of approximately 11,200 men were at work on the project and elsewhere. Multiplying this figure by 4.1, the number of persons in the average family in the United States, it is found that approximately 46,000 persons were fed, clothed, and housed through the expenditures for the project. Approximately 30,000 carloads of materials required in the construction of the project arrived in Boulder City, the cars coming from every State in the Union.

Great as have been the benefits from the economic standpoint, they are small in comparison with those that are accruing and will accrue because of the construction of the dam and power plant. At present, the power transmission line from Boulder Dam to Los Angeles is functioning, and construction is under way on other transmission lines, the Parker Dam, the Los Angeles Aqueduct, and the All-American Canal—none of which would have been physically or economically practical without the construction at Black Canyon. Later will come the erection of factories and plants, the establishment of homes and thriving communities, and all the activity that will accompany the continued development of our southwestern empire.

DOWNSTREAM FACE OF BOULDER DAM. WATER FALLING FROM 12 OUTLETS

FLOOD CONTROL

The second effect of the project is to control floods. With a reservoir of 30,500,000 acre-feet capacity, not only will the lesser floods which may occur during any month of the year be controlled, but also the great run-off occurring in the spring and summer months. In the past, the rate of river discharge has varied from a few thousand to more than 300,000 cubic feet per second. The upper 72 feet of the reservoir, having a capacity of 9,500,000 acre-feet, is reserved for flood-control purposes, and this capacity is not to be encroached upon for the storage of water except as required to control the discharge below the dam to an amount that can be safely carried through the lower valleys without the expenditure of excessive amounts of money for protective works.

In the lower delta country, protective levees had been constructed for a length of 150 miles, of which 75 miles have been destroyed by the river. In 1905 the river breached the levees and discharged uncontrolled through the Imperial Valley and into the Salton Sea for a period of 18 months. The breach was finally closed at a cost of about $2,000,000. This takes no account of large property losses suffered by the inhabitants of the district. In the absence of flood-control facilities, the cost of maintenance of levees alone has, in the past, been approximately $500,000 a year, and even with this large expenditure, the menace was not eliminated. The people have lived in constant fear that the river might again get out of control.

With Boulder Canyon Reservoir functioning, the volume of the large floods passing the dam site will be reduced from 200,000 to 45,000 cubic feet per second, and the extreme flood from 300,000 to about 75,000 cubic feet per second. With this control established, residents of the valleys need no longer fear the ravages of the river, provided of course that they do not fail, through their feeling of security, to maintain the channels and levees to carry even the greatly reduced discharges.

WATER SUPPLY

The third effect of the project is to provide an adequate water supply for irrigation and domestic use. Under present conditions, the average river discharge past the Boulder Dam site is approximately 16,000,000 acre-feet annually. It is estimated that with Boulder Canyon Reservoir functioning, there will be water for 2,100,000 acres of irrigable lands lying below the dam site, including about 200,000 acres in Mexico. At present there are 660,000 acres under cultivation. Of this acreage, 450,000 lie in Imperial and Coachella Valleys, which area can be expanded to about 1,000,000 acres. Those having interests in the Metropolitan Water District of southern California must also look upon the project with some degree of satisfaction, for it provides relief from a condition that made hazardous the further development of the Los Angeles area. The plan adopted, and now being executed, is to carry 1,500 cubic feet per second drawn from storage in the Boulder Canyon Reservoir to the Pacific Coast through an aqueduct 240 miles in length, originating on the Colorado River near the town of Parker, Ariz., and terminating in reservoirs near Riverside, Calif. From this point, deliveries of water will be made through a distribution system to the various cities of the district.

SILT CONTROL

The fourth effect of the project is to provide silt control. The amount of silt carried to the delta annually by the Colorado River has been variously estimated at 88,000 to 137,000 acre-feet. If it may be assumed that the average is 100,000 acre-feet, and if this is expressed in terms of weight, the result is the astounding total of 175,000,000 tons transported to the delta each year. In other words the river, when carrying the average flow of about 22,000 cubic feet per second, transports its load of sand and silt past a given point at the rate of 330 tons per minute.

This silt causes no end of trouble and expense to those who attempt to transport Colorado River water through canals and other irrigation works. Not only does it obstruct the diversion works, canals, and laterals, but the continuous use of silt-laden water in irrigation results in the gradual building up of the ground elevation, especially near points of distribution, with a deposit of material of questionable value. In the past the annual cost of fighting silt in the lower valley is said to have exceeded $1,000,000. In the future, this silt will be trapped to a very large extent, if not entirely, in reservoirs, and it is expected that after a few years the river below Boulder Dam will have established itself in a stabilized channel and that the silt problem in the lower valleys will have been eliminated.

IMPROVEMENT IN NAVIGATION

The fifth effect of the project will be to improve navigation on the river between Boulder and Imperial Dams, the point of diversion for the All-American Canal. Technically, the Colorado is a navigable stream, but under conditions of unregulated flow, navigation was impractical. Ordinarily the discharge at Boulder Dam varied from a minimum of about 3,000 cubic feet per second to a maximum of 150,000. In August 1934 the minimum dropped to 1,780 cubic feet per second, and in 1884 the flow is estimated to have been between 300,000 and 350,000 cubic feet per second. With the river regulated the flow below Boulder Dam will vary, ordinarily, from 12,000 to 20,000 cubic feet per second, the rate of discharge through the power plant depending upon the elevation of the water surface in the reservoir and upon power requirements. The maximum flow to be expected with the river regulated will be about 45,000 cubic feet per second, which will be sufficient to control the usual seasonal flood. This may reach 75,000 cubic feet per second once in about 100 years.

Under conditions of regulated discharge, it is not unreasonable to believe that the river will be used for commercial purposes, particularly by passenger-carrying vessels and by freight carriers in transporting farm products from some of the valleys to railroad crossings and in transporting materials and supplies on the return trip. Safe, dependable water transportation no doubt would also prove advantageous to those engaged in prospecting and in the operation of mines along the river.

RECREATIONAL AREA CREATED

The sixth result of the project will be to create a new recreational area an easy day's drive from several important cities such as Reno, Nev., Salt Lake City, Utah, and Phoenix, Ariz., as well as from the large centers of population in Southern California. The lake to be formed back of Boulder Dam will be unique in that it will be a beautifully clear and sparkling body of deep water in the midst of mountainous desert scenery, in places occupying narrow box canyons such as Black, Boulder, Iceberg, and the lower end of the Grand Canyon.

In the latter case, the river makes its exit from the canyon at Pierce's Ferry, Ariz., above which point the striped canyon walls, cut by numerous vertically walled side canyons, extend upward in towering fashion to the rim, a mile overhead. The side canyons above Pierce's Ferry and the many small bays below will afford an enviable opportunity for those fortunate enough to possess time and facilities to loiter in a district having particular interest for nature lovers, with its high coloring, peculiar geological formations, and traces of an early civilization.

POWER

The seventh and final major result of the project will be the generation of power at a location near a large power market. While the generation of power is only incidental to the principal purposes of the project, it is the returns from power that will repay the cost of the project.

As the water is drawn from the reservoir to supply domestic and irrigation requirements, it will be passed through hydraulic turbines actuating generators. Thus the potential energy stored up in the reservoir can be converted into electricity in large amount. Ultimately the installed turbine capacity will be 1,835,000 horsepower and the rated generator capacity 4,333,000,000 kilowatt-hours per annum of firm power, decreasing each year by 8,760,000 kilowatt-hours owing to upstream development. In addition, there will be available a large amount of secondary power. The ultimate cost of the Boulder Canyon project, including the All-American Canal, is $165,000,000, which cost is to be repaid with interest at 4 percent within a period of 50 years. Existing contracts for the sale of power generated at Boulder Dam are calculated to yield a total return from firm power of $354,038,270 in the 50-year period. Obviously, the project is a self-liquidating one.

FURTHER IRRIGATION URGED BY LATE COMMISSIONER

Dr. Elwood Mead, near the end of his life, said: "Recently the opinion has prevailed in some sections that further construction of irrigation works is uneconomic and injurious. It arose out of an exaggerated conception of the area irrigated under Federal works, which is less than 1 percent of the total farmed area in the United States. Critics of irrigation have not realized how necessary the works being built are to the prosperity of the cities and towns and the industries located in that region. They do not understand the plight of valleys menaced with water shortages. If they did, they would join the West in energetically urging the building of storage reservoirs. It required the great drought to show to the Nation the service which the reservoirs already completed are rendering and the need for early completion of those under way." This view, it is believed, will be confirmed by a study of the aims and results of the Boulder Canyon project. Boulder Dam, dedicated by President Roosevelt on September 30, 1935, is playing its part in reclamation.

Wyoming Reclamation Association Meets

The annual meeting of the Wyoming Reclamation Association was held in Cheyenne on January 20 and 21. Acting Reclamation Commissioner John C. Page sent the following greeting:

"I hope you will have a well-attended and successful meeting. I trust your deliberations will result in further helpful counsel. Just as the association's slogan 'We serve the State' means concentration on your local problems, so we can say of the Federal Bureau of Reclamation, 'We serve the irrigated territory of the United States', but knowing your problems we are in a better position to serve. To President Jenkins and those in attendance at the annual meeting I send my very best regards."

Dr. A. G. Crane, president of Wyoming University, was present at the meeting and delivered an address on the subject "The Industrial Development of Wyoming." Other speakers included Gov. Leslie A. Miller; Perry W. Jenkins, president of the Wyoming Reclamation Association; John Quinn, State Engineer, whose subject was "A Summary of Wyoming's Water Problems"; and Hon. Will G. Metz, W. P. A. director for Wyoming, whose subject was "Recent Developments in the Water Business." Mr. Metz' address included a discussion on the Montana plan of water conservation which has attracted a great deal of attention throughout the West during the past 2 years.

The Reclamation Era

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FEBRUARY 1937

Coming Home

That is the way all of the members of the Reclamation staff feel about moving into the new Interior Building shortly.

In the latter part of 1933 it was found necessary to move certain bureaus of the Interior Department out of the Interior Building to make way for the Public Works Administration and, on October 27, 1933, we left our quarters in the Interior Building, which had been our home since 1918, to enter one of the old wooden temporary office buildings, used during the war, at Sixth and B Streets SW.

In a little less than six months, not only because of the fire hazard but because the buildings were to be razed, we were again faced with moving day and were the first to move into the new Post Office Building at Thirteenth Street and Pennsylvania Avenue. This was on April 2, 1934. The quarters assigned to the Bureau of Reclamation in this building have been very comfortable but, because of the demand for space by the various Government agencies, we were crowded and too many employees placed in one room.

Almost three years have passed and now plans are being laid for the return of the various bureaus of the Interior Department to their own department building.

LOCATION OF BUREAU

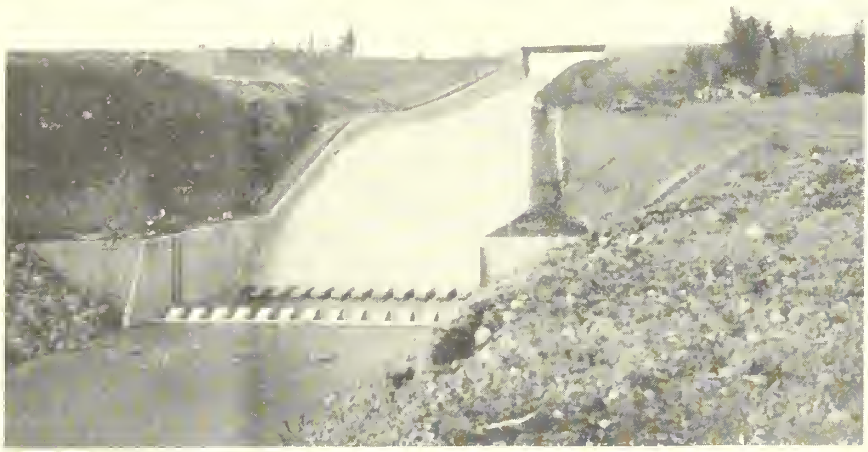
Quarters for the Bureau of Reclamation have been assigned on the seventh floor, where we will occupy several wings in the northwest corner of the building. This happens to be directly opposite the quarters we occupied in the old Interior Building. The building is practically ready for occupancy and moving of the bureaus will commence approximately February 17. Government moving is accomplished in such a way so that there is as little interference with the transaction of business as possible. That means moving at night, Saturday afternoons, Sundays, and holidays. By April 1 we should be one happy family again with bureaus of the Interior Department housed in the two Interior Buildings to be known as the Interior Department and the North Interior Department Buildings. The work of the Bureau will be tremendously simplified by the close proximity of officers of the Department with whom we deal.

The new Interior Building has many outstanding features that are worth a special article on the subject and this I hope to prepare and print in an early issue of the Era.

We will be glad to welcome any visitors from the projects. Come to the Commissioner's office, room 7654.—*M. A. Schnurr.*

Drought-Stricken Families Select Orland Properties

Fifteen families from the Dust Bowl have selected farms obtained for them by the Resettlement Administration and are making active preparations to develop properties. About 1,000 acres have been purchased outright or leased for a term of years with the option of buying. In every case the lands were acquired for amounts far below usual asking prices, and it is believed the new settlers will have every chance of being successful in their new venture. Large landowners have disposed of a very substantial portion of their project properties and in most cases the new owners appear well qualified as farmers.



KACHESS DAM SPILLWAY STRUCTURE YAKIMA PROJECT, WASHINGTON

(Cut along this line)

COMMISSIONER, (Date) ________________

Bureau of Reclamation,

Washington, D. C.

SIR: I am enclosing my check [1] (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) ________________

(Address) ________________

[1] Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Diversion of Columbia River—Grand Coulee Dam[1]

By O. G. F. Markhus, Assistant Engineer

THE article on Columbia River diversion in the November 1935 issue of Reclamation Era outlined the several steps scheduled and contained details of the design and construction of the cellular steel sheet pile cofferdam on the west side. It also referred to the low Wakefield-type timber cofferdam on the east side, built to permit an extension of about 2 months' time for excavation between floodwater periods, prior to the construction of cross-river cofferdams.

Excavation behind the west cofferdam reached a low point in bedrock of 190 feet below the river surface during flood stage in June 1936, with a total seepage through the structure, 3,000 feet in length, of less than 200 gallons per minute—proving it a remarkably tight dam.

That the diversion of the river is a major construction feature at Grand Coulee is indicated in the bid item, "Diversion and care of the river", where $3,500,000 is allocated for that work. The items involved include the large west-side steel cofferdam, the smaller east-side wooden cofferdam, and the two cross-river diversion cofferdams, together with "blocks" 39 and 40 in the dam proper, that will serve as the bottom of the U-shaped enclosure for construction of the dam across the river channel.

River.—The average yearly flow of the Columbia River at Grand Coulee is 109,000 cubic feet per second, with a recorded minimum of 17,500. The average low flow has varied from 25,000 to 35,000, and generally covers the period from September 15 to April 15. Low-water stage elevation is assumed at 935. The maximum recorded flood has reached 492,000, corresponding to an elevation of 981.5 feet. Ten floods over 400,000 in the past 23 years have averaged 445,000, elevation 978. Cofferdamming for river diversion is based on a possible flood of 550,000 with upstream cofferdam at elevation 1,000 and the downstream at 990.

Plan of diversion.—The steps in diverting the river flow, for building the center section and east end of the dam (about 65 percent of the total length), include construction of two cross-river cofferdams, the removal of upstream and downstream wings of the west-side cofferdam, and provision for a passageway for the detoured river.

Steps in diversion plan.—The first construction in the scheme for river diversion was the building of the concrete block of the dam proper that lies directly behind section E—known as block 40—which is joined at its upstream end to section D of the west cofferdam by steel cells and on the downstream end by a gravel-filled timber crib and steel cells to section G. Concrete was placed to elevation 1,000, and the bulkhead crib in the bucket and on the downstream slope was built up to elevation 950. This was followed by construction of block 39, adjoining it on the west, with concrete placed to the same elevation and the bucket-slope crib to 990. These two blocks, together with cell clusters, or abutments D and G, form the bottom of the U-shaped cofferdam unit for river diversion. The placing of block 40 was a difficult and expensive piece of construction in that it was partly built inside a "steel box" of sheet piling 80 feet wide, 550 feet long, and 60 feet deep, and so filled with heavy timber bracing that there was little room left for excavation and placing of concrete.

The next step was to provide waterways through the dam under construction behind the west cofferdam. River flows up to 85,000 cubic feet per second will be carried by four passages, made by leaving the four blocks between block 39 and the spillway training wall at the approximate elevation of the river bed—elevation 910. These waterways are each 50 feet wide, 40 feet deep, and 340 feet long on the bottom. When the river stage reaches elevation 950, seven additional blocks, left low in the powerhouse section, come into play with 256 feet of width, making a total spillway crest of 576 feet above the 950-foot elevation. Computations and tests on laboratory models indicate that these passages will handle flows up to 550,000 cubic feet per second with maximum velocities of 32 feet per second and water elevations reaching to 992 feet back of the dam. A flood of 400,000 cubic feet per second may reasonably be expected in June, which would give velocities up to 25 feet per second through some of the passageways, and a maximum elevation of 984 feet directly back of the dam. As the upstream cross-river cofferdam, cell cluster D and blocks 39 and 40, are at elevation 1,000, this would leave a freeboard of 16 feet.

The third step in river diversion work was excavation of the upstream end of the diversion channel; removal of the fill and back walls of sections A and B (south shore arm of west cofferdam), and the steel piling to slope surface. Cells 1 to 6 in section C were then removed to elevation 930, and cells 7, 8, and 9 to elevation shown on sketch plan. The tops of these three cells were capped with concrete to prevent washing out of the gravel fill. The channel was excavated to elevation 920, using Diesel and electric shovels in loading Athey buggies, hauling to a feeder and lateral of the conveyor system, running to a spoil pile in Rattlesnake Canyon, a mile and a half distant. This was followed by excavation with similar equipment of the downstream channel, between the dam and sections H and I, to elevation 910, or lower. Piling in sections I and J was removed to slope surface and in section H to elevation 945.

Meanwhile, the bottoms of the main channel cribs for the two cross-river cofferdams were built on the floor of the upstream diversion channel. These were "tailored" to fit the contour of the river bed, from some 50,000 river soundings taken on 2-foot centers. After flooding, the cribs were floated into the river channel for placement, or temporarily anchored to the east river bank.

Water for flooding was let in through three 36-inch valves mounted in the inner wall of cell C–6, followed by excavation of an opening in the dike in front of

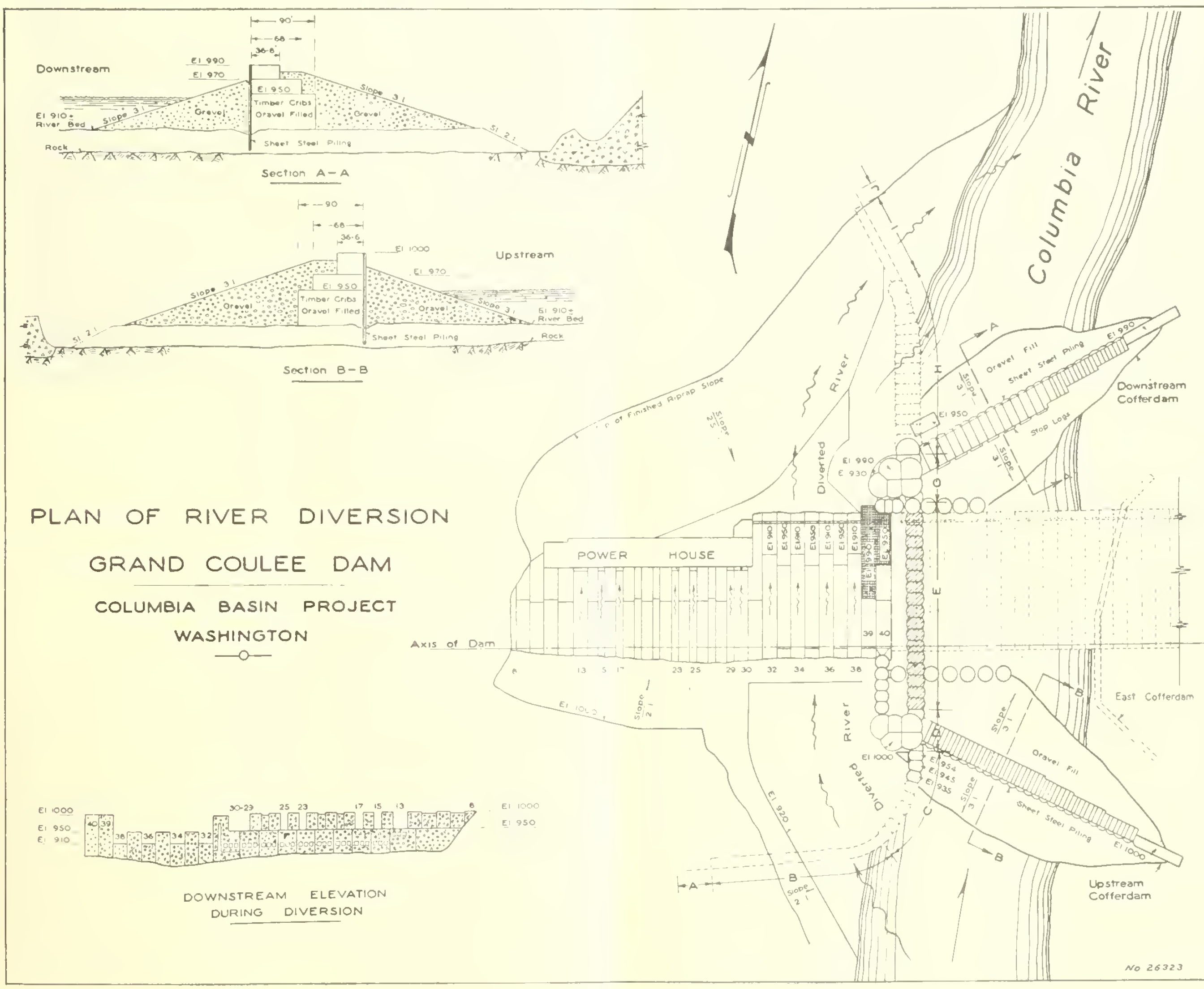
[1] See illus. on back cover.

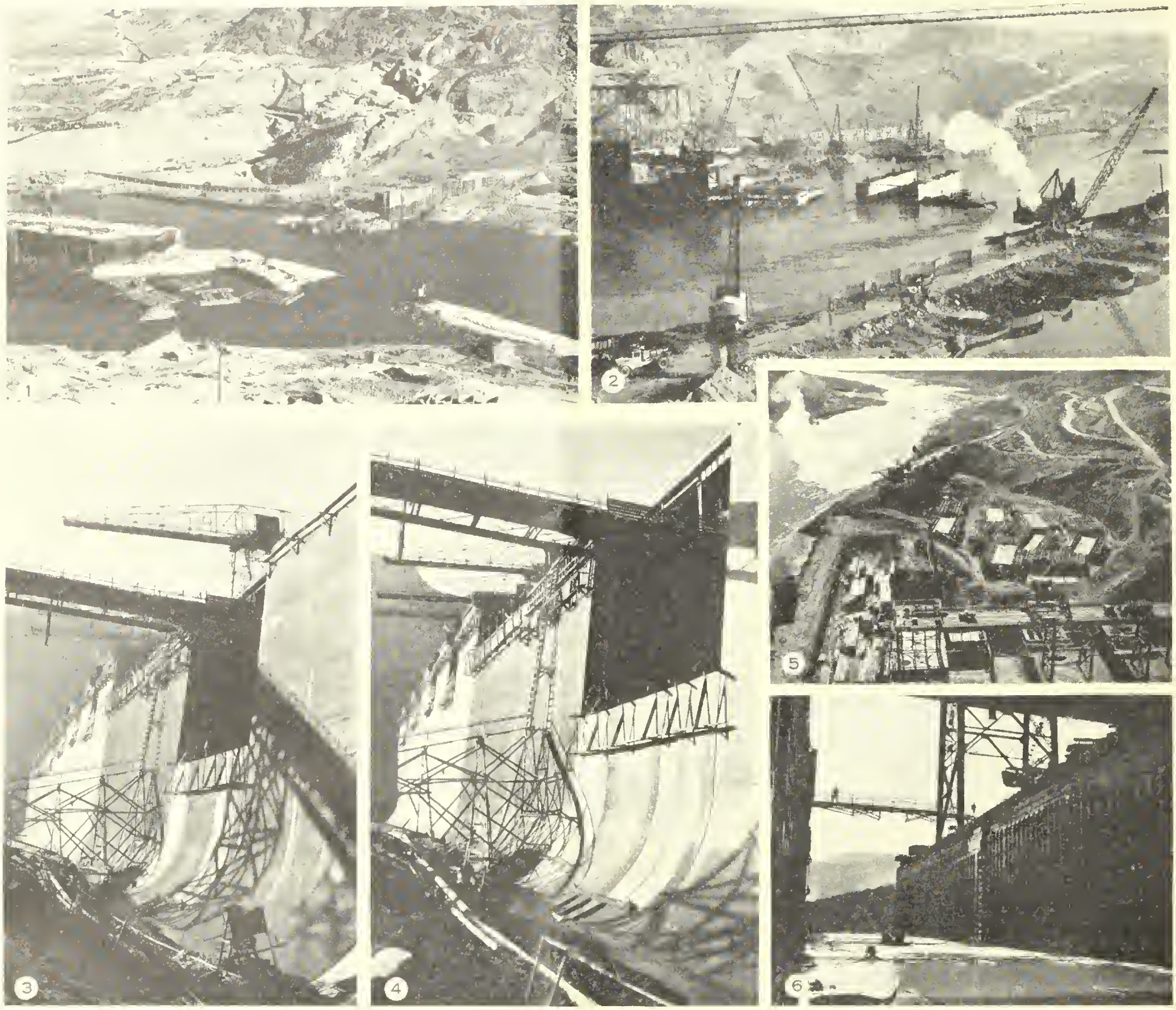
sections C and B. At the same time the diverson channel outlet was opened through section H (the downstream wing of the west cofferdam), where the fill within the steel cells was excavated from elevation 945 to elevation 910 (approximate river bottom), and bottom steel piling removed.

Removing steel cofferdam cells.—In removing the shore ends of the west cofferdam for river diversion, the fill was washed out through openings cut in the river side walls of the steel cells by means of "giant nozzles" connected to 12- and 10-inch feeders supplied by 5,000 and 3,000 gallons-per-minute pumps mounted on cribwork on the river backfill. The first step removed the material to elevation 960, where the piling was cut and another set of openings made for excavation to 945. Nozzles were also used in cutting material away from the discharge holes. Removal of fill from elevation 945 to 925 was by means of clam-shell rigs mounted on barges, loading to trucks, and from 925 to 910 by the same rigs dumping into the river. The steel piling, which had a 30-to-40 foot penetration in dense clay, and a "refusal point" of fifty 6½-foot-ton blows to the inch, were then quite easily removed by extractors.

Cross-river cofferdams.—These are substantially "earth-filled" dams with steel piling center-cores supported by arms extending from gravel-filled timber cribs. The shore ends of the upstream and downstream cross-river cofferdams are about 2,000 feet apart, the two coffers extending from the east bank at an angle of 25½° downstream and 27½° upstream, respectively, each about 1,000 feet long, to cell clusters D and G in the steel cofferdam on the west side. These clusters, about 800 feet apart, serve as buttresses, and are in turn connected, through steel cells and cribs, to concrete blocks 40 and 39 in the dam proper. This forms a U-shaped enclosure of about 55 acres, to be unwatered for construction of the center and east sections of the dam itself. These dams consist of three sections. The extreme shore end is of vertical timber sheeting inside wall and a straight interlocking sheet steel piling outside wall, tied with rods through horizontal walers—known as the Ohio River type crib. This section is 220 feet long in the downstream dam and 180 feet in the upstream dam. Next is a section of standard built-in-place cribs, 336 and 368 feet in length in the two dams, respectively. Then come the river sections, 448 feet long in each dam.

River bottom elevation is approximately at elevation 910, and bedrock about 880. The 30-foot overburden in the river bed is about 90 percent "clay", with practically no sand and gravel, but a top layer, or armor, of boulders that are more or less movable in flood periods. Seven of the eight downstream river cribs are U-shaped, 64 feet wide and 90 feet long (parallel with stream flow). The sides are 16 feet wide, leaving a water passage 32 feet wide for river flow. It is expected that with low water flow these seven openings (total, 224 feet) will not





COLUMBIA BASIN PROJECT, WASHINGTON

1, View looking east across the entrance to the diversion channel, showing cribs ready to be moved out; 2, maneuvering a foundation crib into position in down-strea cross-river cofferdam; 3 and 4, portions of upstream face of Grand Coulee dam; 5, bottom crib sections of downstream cross-river coffer-dam built directly behind tl original cellular steel cofferdam on west side of river diversion channel; 6, one of 4 channels used for diverting the Columbia River while the center portion of Gran Coulee dam is being built.

develop a head of more than 2 feet between the upstream and downstream sides of the cribs. After the cribs are all in place and built up to elevation 942, stop logs in 5-foot lifts will be placed, gradually closing off the entire river.

When the cribs have been built up to elevation 942, and stop logs placed, a trench 8 feet wide on the bottom is excavated on the river side by a whirley and clamshell, for the sheet piling set in arcs spanning the 32-foot openings, and the 32-foot combined width of the joined vertical U sides. The arcs are joined to Y's built up from standard piling and the wall supported by means of $3\frac{1}{2}$ by $\frac{5}{8}$ inch strap loops to a 4-inch pin, around which is a similar loop attached to a 12 by 12-inch timber extending about 6 feet out from the cribs. The same 32-foot span arcs of sheet piling are continued in the shore end of the cofferdam.

The river cribs in the upstream cofferdam have the shape, in plan, of a box with projecting ends. The over-all width is 64 feet and the length 86 feet (parallel to river flow), with the space enclosed, 17 feet by 61 feet. The projecting ends extend out $8\frac{1}{2}$ feet, so that when the cribs are in position with the projecting ends abutting, there is formed a series of open wells all of the same dimensions. The arcs of the upstream sheet piling have the same 32-foot span as downstream, and cover each butt-joint.

The placing of cribs was handled by a large maneuvering barge, equipped with a 6-drum and a 4-drum hoist, and boiler. The barge was anchored to an upstream crib by means of a 3-inch cable—this also taking strain from the 2-inch crib-lea cables—through a specially built ste structure on the barge. The barge wa controlled by hoisting engines on bot banks of the river.

The steel piles, of the standard inte locking type, are the same as was use in the west cofferdam, 15 inches wide an weigh 38.8 pounds per foot. Penetratic into the dense "clay" is 15 to 30 feet, to "sound driving."

The schedule of operations for riv diversion prepared in June 1936 has be met quite consistently. Water was l into the diversion channel for flooding November 5, 1936, followed by the ope ing of the upstream dike to a sufficie depth and width for transporting t cribs out for placement. This w immediately followed by the removal

the lower part of section H at the outlet of the downstream channel, thus creating a bypass and partly relieving increasing velocity due to extension of the downstream cofferdam into the channel. The final crib in this cofferdam was placed December 9, 1 day ahead of the scheduled date. The placing of stop logs in consecutive lifts of 5 feet was accomplished in about 30 hours' time, and filling of the downstream cofferdam to the necessary elevation for complete diversion was finished 2 days later—2 months ahead of schedule.

Unwatering was started January 3, 1937, and the 80,000,000 gallons pumped out in 6 days, immediately followed by the placing of a fleet of dozers, shovels, and other excavating equipment, so that actual excavation of the river channel was commenced January 9—also approximately 60 days ahead of the time planned. This was made possible because of the low stage of the river this winter, and will mean that the removal of overburden will have progressed to the point that rock excavation may be started about the middle of February. The placing of concrete in the center section of the dam will therefore begin about May 1. Removal of the cross-river cofferdams is now scheduled to begin in September, and filling of the blocks left low for river diversion is scheduled for October and November.

As an item of interest, the cross-river timber crib cofferdams contain more than 9,000,000 board feet of lumber, and the timber cribs on the front face of blocks 39 and 40, something in excess of 2,000,000 board feet. The smallest "stick" is 12 by 12 inches and the largest is 16 by 24 inches—all proved western fir—and 40 feet to 60 feet in length. These cofferdams have a total height from bedrock of about 90 feet and will have a total fill exceeding 950,000 cubic yards; 2,200 tons of steel piling will be used before work is completed; and better than 600,000 pounds of driftpins.

Construction equipment included three revolving cranes, three excavating rigs—dragline and clamshells—three stiff-leg cranes, three skid derricks, two 3-drum hoists, one 4-drum hoist, one 6-drum hoist, 11 barges—the largest 40 by 125 feet—two powerful tugs, a barge for diving equipment, in addition to a fleet of 8- and 12-yard trucks, shovels, etc. Cables for anchoring and placing of cribs included 750 feet of 3-inch, over 12,000 feet of 1¼-inch, and a large amount of 1½-inch.

The general plan of diversion contemplated a possible low-water flow of 45,000 cubic feet per second. The actual minimum flow experienced was about 21,000 cubic feet per second. The resultant saving in cofferdam elevations for complete diversion has made it possible to advance concrete placing so that the contractor—The Mason-Walsh-Atkinson-Kier Co.—confidently expects to complete its contract of approximately 4,500,000 cubic yards by the end of this year or early in 1938. Harvey M. Slocum is general superintendent for the contractor; C. D. Riddle, chief engineer; and R. L. Telford, cofferdam engineer.

Third Annual Orange Fiesta and Turkey Show

On December 4 and 5, 1936, the third annual orange fiesta and turkey show was staged in Orland and was very successful in every way. The exhibits were housed in a large tent and attracted a great deal of attention. The showing of dressed turkeys was especially fine both from the standpoint of quantity and quality. In addition to a very fine showing of citrus fruits, exhibits of home-packed dried fruits and other farm products were on display. The Orland Grange dedicated its new $10,000 home which was constructed almost entirely by the donated labor of Grange members. It is a credit both to the community and the organization.

CHRISTMAS retail sales in Powell, Shoshone project, Wyoming, surpassed by far anyone's expectations, and although the local merchants had stocked their shelves with what they thought would be sufficient to meet the demands, a week before Christmas they were ordering by telephone for more merchandise. It is the general opinion that the year 1936 was above the most successful the Powell Valley farmers and businessmen have experienced. There was a good harvest, a favorable season for harvesting the crop, and good prices prevailed.

Westward Migration

Voluntary migration westward of hundreds of families from the drought-stricken areas of the Great Plains has served this year to emphasize the pressing need for opportunities in the arid West for the establishment of homes on land protected by irrigation canals. During 1936 clamor for farms and homesteads on Federal Reclamation projects in the Western States, particularly in the Northwest, reached a new high point.

A marked movement westward of families from the drought area began in 1934, which was a year of critical drought, and reached a climax during 1936, when between January 1 and September 15 a total of 2,329 farm families entered Washington, 1,930, Oregon, and about 4,500 entered Idaho from the Great Plains drought areas. During the first 6 months of the year 27,800 persons from these areas migrated to California.

The large majority of these families moved in automobiles loaded to capacity with personal and household goods, quite frankly searching for places to resettle in localities where stored water and canals provide protection from calamities similar to those experienced in the Dust Bowl. Some, however, sought employment in the seasonal harvests of the irrigated sections, intending to return to their homes.

There is ample evidence also that in addition to those who left their Great Plains homes, many still there are interested in seeking new opportunities on irrigation projects farther west.

INTEREST IN IRRIGATED AREAS

An announcement was made October 28 that 57 public land homesteads were available on the Gooding division of the Minidoka project in Idaho. By December 3, a total of 934 inquiries about these farm units had been received. Inquiries have been received at a rate of 30 or more a day since that time. The greatest number of these have come from the Dust Bowl. In addition to those writing for additional information, scores have called at the project office personally to investigate the possibilities of reestablishing themselves on these homesteads.

"A comparatively small number of the immigrants reaching the western States have the necessary resources to homestead under the Reclamation Act, by the provisions of which settlers are required to have a capital of $2,000," Mr. Page, Acting Commissioner of Reclamation, said: "However, some have sufficient capital to homestead under these conditions and some have sufficient capital to buy outright improved farms on Federal projects or unimproved land offered for sale under irrigation canals."

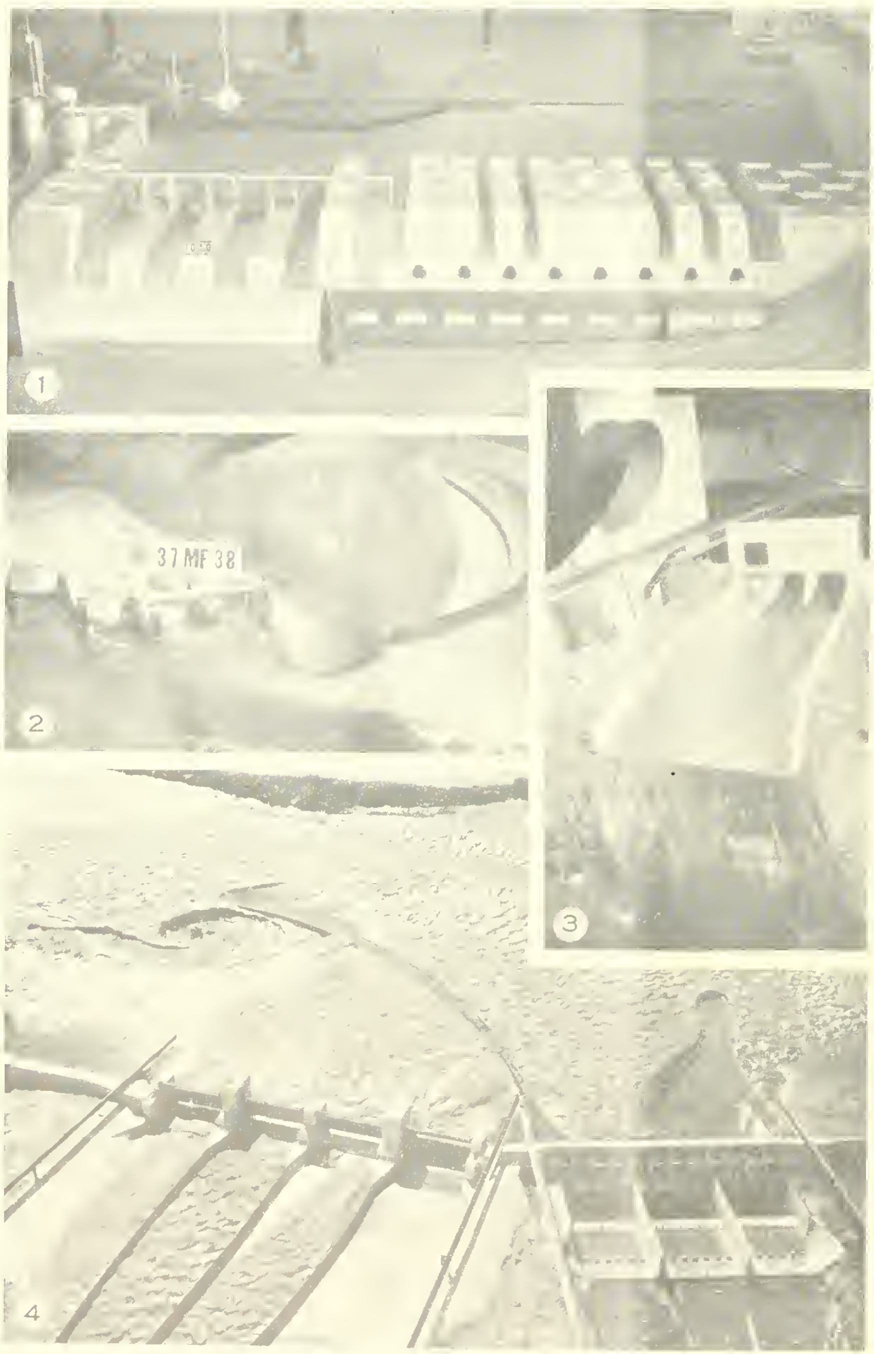
The largest offering of new land this year was made on the Owyhee project in eastern Oregon. There, 107 public land farm units were advertised. All but 33 were claimed by bona-fide settlers who were able to show that they had the

(Continued on p. 35)

Hydraulic Models Aid Design of Reclamation Structures

By D. P. Barnes, Associate Engineer, Bureau of Reclamation

THE study of hydraulic models in conjunction with the design of spillways and stilling pools, canal transitions, gates, or any of the other innumerable structures affecting control of water has come into general use in the United States only within the past 6 or 7 years. Within this period the growth of laboratories equipped to handle the quick temporary construction required by the relatively brief time allotted to design under practical construction conditions has been extraordinarily rapid. Of 21 laboratories listed in the October 1935 bulletin of the National Bureau of Standards as actively engaged in model work, only 5 or 6 were in existence and similarly operating before 1930. Included among the recently developed laboratories are the three now operated by the Bureau of Reclamation in Denver, Fort Collins, and Montrose.



1, GRAND COULEE CONSTRUCTION MODEL; 2, AN ABANDONED DESIGN FOR THE MORMON FLAT SPILLWAY; 3, THE CURVED AND SUPERELEVATED BARTLETT SPILLWAY; 4, MODEL OF ALL-AMERICAN CANAL HEADWORKS.

PROBLEMS STUDIED

The problems studied in these laboratories are numerous and varied. Some of them, such as the spillways for the Mormon Flat and Gibson Dams, have been quantitative and have involved the empirical determination of approach and crest shapes that would pass "design" floods with minimum costs and safe pond levels. Likewise quantitative are the efficiency tests being made on turbine assemblies, draft tubes, needle valves, etc. On the other hand, many studies of the performance of stilling pools and of the flow characteristics in chutes and transition sections are primarily comparative. Although measurements are made of the scour produced below sills of model stilling pools, only the general character and relative magnitudes of the scour pockets are considered reliable.

VALUE OF MODEL TESTING

It is now well recognized that complete similarity between models and their prototypes is mathematically and physically impracticable, if not impossible. Using the commercially available fluids, air under atmospheric pressure, and workable model materials, such quantities as viscosity, surface tension, surface geometry (roughness), and hydrostatic pressure cannot be reduced in proportions exactly consistent with the geometric scales. The value of model testing today is therefore based upon the freedom of the experimenter to select the necessary distortions in such a way that those elements of prototype behavior which are the essential objects of the investigation can be correctly extrapolated from the model behavior. For example, a model of the spillway for the Moon Lake Dam was constructed to a linear scale ratio of 1:60. The effects of disproportionate viscous forces (Reynolds' number effects) were neglected because within the range selected their influence is generally assumed to be unimportant. Surface tension effects were neglected for the same reason. However, the disproportionate roughnesses of the model surfaces would have affected the velocities in the stilling pool by as much as 5 percent. In order to more faithfully anticipate type velocities, the roughness distortion was therefore compensated by an increase in total drop.

The major technical problem in applying model studies to design work is thus seen to be one of properly interpreting and allowing for the unavoidable dissimilarities.

LABORATORY EQUIPMENT

Although the credit for the first great strides in the development of model laboratories must be given to the European experimenters, the technique evolved in this country during the past few years is peculiarly American. Essential to all laboratories of course are the pumps and storage basins, and the skimming tanks for maintaining constant head. In addition to these, the older European laboratories are generally equipped with permanent, rectangular flumes of assorted shapes and sizes, either fixed to the floor or too heavy to be moved. Although this type of installation has certain advantages, it requires that models must be fitted into the available flumes. Much more suited to American needs is the temporary construction now prevalent in the "design" laboratories of the United States.

MODEL MATERIALS

The principal model materials used in the Reclamation laboratories are wood, sheet metal, cement, plaster, and, more recently, pyralin. The wood-framed, sheet-metal-lined tanks in which most of the models are built have dimensions which range in plan from about 2 by 6 feet to 8 by 20 feet and in depth from 1½ to 4 feet, with larger structures in exceptional cases. They are easily adapted to the space requirements in crowded quarters and can be quickly cut, altered, or removed. Most models require the control of tail water in accordance with a recorded or calculated rating curve. This control is usually supplied by means of a crude tail gate hinged at the bottom and operated with a crank. Water from the model spills over the tail gate, and is returned through the measuring weir to the pump sump in sheet-metal flumes.

Because of the necessity of streamlining, many of the hydraulic shapes are difficult to reproduce in model sizes. Sheet metal cannot be used effectively for warped surfaces, such as those frequently required in open channel transition sections, spillway chutes with banked turns, or draft tube models. Surfaces of this kind are now generally made of neat cement finished to fit sheet-metal templates or of pyralin. A successful variation of the cement technique was recently achieved in the casting of the Gibson "glory hole" spillway. A sugar pine mold was filled with a mixture of 33 percent plaster and 67 percent portland cement at the lowest workable water content. The shrinkage proved negligible, and the finished casting was not so hard but that it could be chipped away to conform to proposed changes.

In the construction of piers, abutments, and sills, cypress and redwood have been found most satisfactory. These are easily worked, yield a smooth, close surface texture, and are subject to but slight swelling. The cypress is considerably superior to the redwood.

The uses of pyralin (a clear, sheet celluloid) in model construction are only beginning to be appreciated. Tenth and quarter-inch sheets can be used for any flat surfaces. Edges may be joined by welding with acetone, or may be fastened to wood or metal with screws. Pyralin has been pressed into wood molds to produce scroll cases and draft tubes. It has a visibility almost as satisfactory as that of glass, but may be drilled and clamped without danger of cracking. It has proved almost ideal for observing and photographing the flow through tunnels and gate transitions. A thorough motion picture study of the flow through the draft-tube-like "influent slot" of the desilting works for the All-American Canal has just been completed with the aid of pyralin side walls.

MODEL CONSTRUCTION JUSTIFIED

Although occasionally a model may be constructed under a mistaken impression of the applicability of the results expected, it would be difficult to find an example whose cost was not fully justified by the confirmation of anticipation, the disclosure of unfavorable flow conditions, or the development of simplified designs. In some instances, as in the case of the Imperial model shown in the illustration, the design has been entirely dependent upon expedients proposed and tried as a result of model observations. The Grand Coulee construction model was used to determine a construction schedule which would permit the proper flood discharge without injury to the riprap on the tailrace slopes. The condition indicated in the Mormon Flat picture was largely responsible for the abandonment of the type of spillway crest illustrated. Although a curved approach was found which induced adequate flow through the end gate, the large draw-down resulted in unbalanced hydrostatic forces that made construction of the curved wall impracticable. To have predicted the various possibilities of this approach mathematically would have been a virtual impossibility. Similarly impossible would have been any rational calculation of the splash height shown in the picture of the Bartlett model for an unsymmetrical gate opening. Here again the decision as to the adequate wall height, super-elevation, and slope, rested largely upon model confirmation of the proposed design.

The hydraulic model is rapidly achieving recognition as an indispensable adjunct to engineering design. That Colorado should be host to three progressive and efficient model laboratories is another evidence of the State's leading part in engineering activities.

The hydraulic laboratories of the Bureau of Reclamation are directed by J. E. Warnock, under the general supervision of Arthur Ruettgers, research engineer. All the design studies and investigations are under the supervision of J. L. Savage, chief designing engineer. All engineering and construction are under the general direction of R. F. Walter, chief engineer.

Westward Migration

(Continued from p. 33)

required capital to improve their homesteads. The units remaining are comparatively rough and will require considerable labor in the subjugation of the land. Groups of men from the drought area have applied each day at the project offices. Many did not have sufficient capital to qualify as settlers. Others bought unimproved lands susceptible of irrigation in the vicinity.

The Yakima project, an old and well-established agricultural area in eastern Washington, attracted large numbers of families from the drought area, some of whom made the trip to eastern Washington only to seek seasonal employment in the fruit harvest. Many of them, however, were anxious to become permanent settlers in that area.

The Bureau of Reclamation has under construction a new division of the Yakima project, the Roza division, which eventually will provide water for about 72,000 acres of sage brush land. Had this land been available this year, it is probable that all of it would have been settled immediately and that the largest number of settlers would have been found among those refugees from the Great Plains drought area.

Reports from Bureau of Reclamation officials in Yakima show that 3,800 persons went to that project from the drought area during 1936. Of this number, 800 actually were settled on farms in the Yakima Valley, some of them purchased from the Federal land bank and others provided by subdivision of farms in crop. In addition, 700 well-qualified farmers made earnest efforts to locate in Yakima Valley but were unable to find vacant property.

A Weed Eradication Program

THE drawing of the single-blade weed eradicator, shown on the opposite page is taken from the current slide lecture of the Bureau of Reclamation on the subject "New Ideas in Irrigation Agriculture", and is published here so that all farmers troubled with infestation of perennial weeds, such as wild morning glory, Russian knapweed, and white top, may have the plan for constructing this simple, inexpensive root-cutting tool.

Underground root-cutting is recommended as an effective and economical method for eradication of fast spreading perennial weeds. The single-blade eradicator, designed for this work, has a long, sharp-cutting blade. This blade, pulled through the soil at a depth of about 5 inches, cuts through the toughest, creeping perennial weed roots. The depth of the cutting is controlled by the roller. This roller can be moved up or down to get the proper depth.

The weight of the operator, who stands on the riding platform when driving the team, aids in keeping the blade at a constant depth. If the soil is hard, the driver should stand directly over the blade; while if the soil is of sandy content, he should stand at the lower end of the riding platform.

The single-blade eradicator can be built for use with one or two horses. For one horse, the blade should be about 3 feet in length. An eradicator of this size is especially well adapted for small patches of weeds. When two horses are to be used, the blade should be about 6 feet long. For any purpose, the blade should not exceed 9 feet in length because shorter blades allow for uneveness in the ground surface and do not miss any roots.

An eradicator with a two-horse team can cut in 8 hours 5 to 7 acres. Therefore a weed eradicator, planed for neighborhood use, will serve 30 to 40 acres provided the farms are fairly near each other.

The time to start a cutting program on established perennial weeds is early spring or midsummer. Some authorities claim that midsummer when the perennial is in full bloom and thus in its weakest condition, is an ideal time to start root cutting. Others favor early spring because the growth and regrowth are most rapid then and frequent recutting weakens the intricate root systems more rapily.

Whenever you start root cutting, prepare the field or plot as you would for seeding a grain crop. Wait for the first weed shoots to appear, then go over the field with the weed eradicator.

The number of root cuttings required to kill perennial weeds varies with the weed, the amount of food supply in storage, and the soil and growing conditions. Do not be discouraged if the perennial weeds are not entirely killed in one season. Experiments show that two seasons are required to fully eradicate well-established and sturdy varieties. The second season, however, the weeds will not be so healthy.

After a weed-cutting program has been carefully and persistently followed until no new shoots appear, plant row crops, watch the row crops for any possible scattered perennial weeds, and, if a few appear, make a similar cutting campaign with the good old hoe. When the farmer is assured no live roots remain, grain and alfalfa may be planted, but do not plant such crops the first season after a cutting program.

The soil should be kept in favorable condition for plant growth while cutting to destroy perennial weeds. It may be necessary to irrigate once or twice during the growing season. This, in addition to germinating any weed seeds, will speed up growth of young sprouts, thus depleting more rapidly the stored-up food supply in the roots.

The single-blade eradicator is also valuable for killing annual weeds, especially such pests as pigeon grass and sandburs. Several days after a field has been prepared for seeding and the young tender shoots of the weeds appear, draw the eradicator over the field. Do this a day or two before planting. The blade should be adjusted so that it will be just under the ground. This is sometimes termed "giving the weeds a close shave".

The important point to keep in mind in a weed-eradication program is that *once started (and it must be started if the farmer is to continue cropping his land), it must be followed consistently until all roots have been destroyed.*

As every farmer knows, there is no easy panacea for eradicating long-lived, fast-spreading perennials. Drastic action to destroy every perennial as soon as discovered is the best cure for the losses these weeds bring to crops and the value of the land.

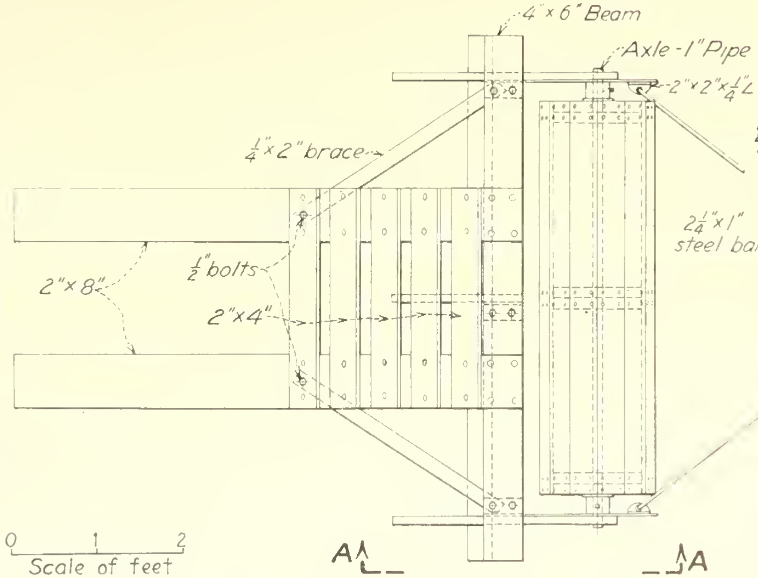
CUTTING WEED ROOTS WITH A SINGLE-BLADE ERADICATOR

KNOW YOUR WEEDS

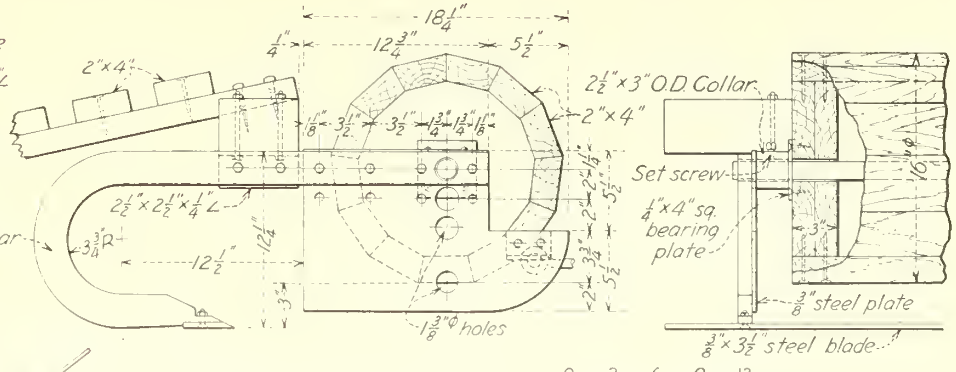
First in a program to eradicate weeds every farmer should know the names and habits of the weeds in his community, which weeds are annuals, biennials, or perennials, and he should also know the best methods for exterminating the different varieties.

An interesting lecture, "New Ideas in Irrigation Agriculture", accompanied by 56 colored slides, photographed by Bureau of Reclamation field men during 1936, presents information on the use of the single-blade weed eradicator and gives other successful methods for exterminating noxious weeds. This slide lecture also shows improved methods in irrigation, useful up-to-date farm tools (both homemade and commercially designed) and offers suggestions for making waste land productive. The program is of interest to stockmen and irrigation farmers.

Any group interested in such a program on better irrigation farming may secure this slide lecture for a community meeting by writing John C. Page, Commissioner, Bureau of Reclamation, Washington, D. C.



PLAN



VIEW A-A

DESCRIPTION

The blade is of plow steel 3½" wide × $\frac{3}{8}$" thick. Discarded road grader blades are satisfactory. Length of blade and beam should be 3' ± per horse.

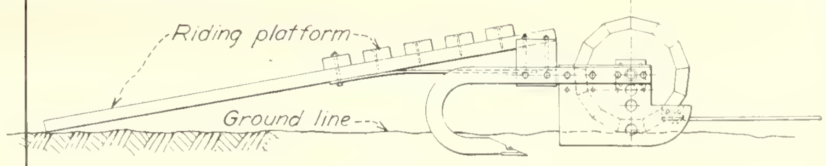
The beam should be of good grade lumber, 4 × 6".

The steel bars to which the blade is fastened by plow bolts are 2$\frac{1}{4}$" x steel or equivalent in strength. These bars are fastened to the 4" × 6" beam by 2$\frac{1}{2}$" × 2$\frac{1}{2}$" × $\frac{1}{4}$" std angle irons. The two outside bars extend 13" beyond the 4" × 6" beam to allow connections for an 18$\frac{1}{4}$" × 11" × $\frac{3}{8}$" steel plate.

These plates are used to hold the roller in place. The device for connecting the eradicator to the double-trees or tractor is also fastened to the plates.

The roller regulates the depth of the cutting blade. It breaks up clods, thus maintaining a satisfactory surface mulch. By placing the ends of its axle in the bottom holes of the plates, the roller can be used to move the eradicator from field to field or from one farm to another.

The riding platform may be used to raise the eradicator onto the roller whenever the blade needs to have weeds and roots removed.



ELEVATION

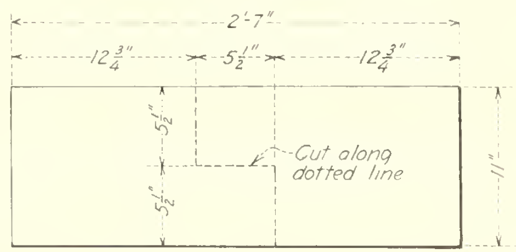


DIAGRAM FOR CUTTING $\frac{3}{8}$" PLATE

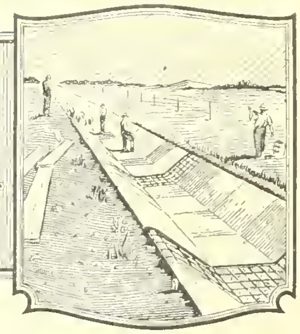
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
DIVISON OF OPERATION AND MAINTENANCE

SINGLE-BLADE WEED ERADICATOR

DRAWN: F.C.S. SUBMITTED: L. H. Mitchell
TRACED: F.C.S. RECOMMENDED:
CHECKED: APPROVED: [signature]

WASHINGTON, D.C. JAN. 2, 1937 — 26236

EMERGENCY CONSERVATION WORK
Civilian Conservation Corps



Reclamation Work Trains C. C. C. Men

By Afred R. Golzé, Supervising Engineer, E. C. W.

THE Civilian Conservation Corps is serving the Nation in two major fields—the conservation of its unemployed youth and the conservation of its natural resources.

Located on 26 different reclamation projects, 35 E. C. W. camps have reported on the employment of C. C. C. enrollees. The training of young men and the placing of them in good jobs, equipped as they otherwise could not have been to make a place for themselves, is one of the finest achievements of the C. C. C. The records of Bureau of Reclamation camps show that over an average period of 1 year, 1,430 enrollees have secured gainful employment on leaving the Corps. This is at the rate of 41 men per camp, but in view of the inability of many camps to report complete figures, the actual number per camp may be higher. Those camps which have available full records report as high as 100 or more C. C. C. enrollees discharged to accept positions, or more than a 60-percent turnover on this account in a year.

TYPES OF WORK

All types of work are obtained by enrollees on leaving the Civilian Conservation Corps. Job training in the reclamation camps is given primarily in the field occupational groups such as tractor operators, truck drivers, dragline and Ruth dredger operators, mechanics, carpenters, masons, lumbermen, surveyors, and also by the Army and the Bureau in the occupations ordinarily part of the camp overhead, such as clerks, cooks, bakers, and in allied positions in both groups.

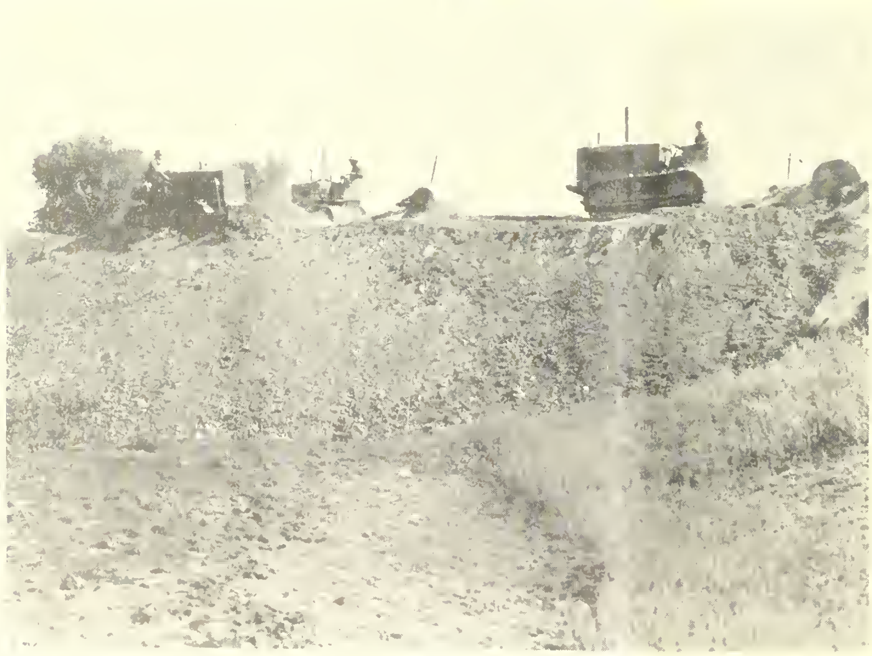
Although reclamation training of C. C. C. men is primarily confined to the above-mentioned types of work, C. C. C. men from the reclamation camps have returned to private life as farmers, farm hands, ranch hands, miners, railroad workers, skilled labor helpers, lumberjacks, highway workers, factory workers, welders, painters, photographers, and musicians, to enumerate a few.

Positions obtained by former C. C. C. enrollees range in pay from $40 per month to as high as $135 per month. The records indicate that the higher-paying positions are filled by enrollees who have served a considerable time in the C. C. C., at least a year or longer.

Typical cases of employment are of interest. A former enrollee, age 21, of Camp BR–41, at Klamath Falls, Oreg., now has a job as a machine operator for a local timber company at $4.50 per day, after 12 months in the C. C. C., 6 of which were with the Bureau of Reclamation. A 25-year-old former C. C. C. man from Camp BR–3, Carlsbad, N. Mex., is locally employed as a miner at $5 per day, after 25 months in the Corps, 9 of which were with this Bureau.

The contractor for the Grand Coulee Dam on the Columbia Basin project has employed a 23-year-old tractor operator at 75 cents per hour, who received his training in serving 28 months with the C. C. C., 8 months of which were spent in Camp BR–48 at Grand Coulee Dam. A former C. C. C. enrollee is now employed in San Antonio, Tex., as a rock mason and earning $1 per hour as a result of 24 months' training in this class of work in Camp BR–4 at Ysleta, Tex., on the Rio Grande project.

In order to afford opportunity for advancement within the C. C. C., outstanding enrollees are promoted to responsible positions as foremen on the technical supervisory staff at the camps, when a vacancy occurs and an eligible enrollee is available. The records of the Washington office show that in the past year and a half of active operation of C. C. C. camps by this Bureau, 37 campforemen appointments have been made to reclamation camps by the Secretary of the Interior, through the promotion of C. C. C. enrollees, and that he has appointed by promotion three other enrollees to clerical positions in E. C. W. The salaries paid these men range from $105 to $135 per month, depending upon their duties. This is a worthwhile award for meritorious work for C. C. C. enrollees.



C. C. C. ENROLLEES OPERATING TRACTORS AND TUMBLEBUGS CONSTRUCTING SMALL EARTHFILL DAM TO STORE DRAINAGE WATER CAMP BR–2, BELLE FOURCHE PROJECT, SOUTH DAKOTA

C. C. C. ENROLLEES BUILDINO GRANITE RETAINING WALLS IN TOWN OF COULEE DAM—CAMP BR 48, COLUMBIA BASIN PROJECT, WASHINGTON

BENEFITS OF TWO KINDS

The benefits of reclamation work to C. C. C. men is of two kinds; first, the teaching of new trades and job training given those who were untrained when they entered the corps; and second, the provision for active continuation and improvement for those who had some experience in trades and crafts before becoming members of the corps.

As an example of the first class, the value of C. C. C. training to the men enrolled in Camp BR–11 at Bridgeland in eastern Utah, may be cited. The enrollees from this camp have been developing a supplemental water supply for the Moon Lake project by the construction of the Midview Reservoir and related canal system. Heavy equipment has been required for the construction of the dams and canals. Diesel tractors, with and without bulldozer attachments, carry-all scrapers, draglines, and varied types of accessory equipment have been utilized. The enrollees of this camp have availed themselves of the opportunity afforded to become efficient machine operators and to learn to repair and maintain the equipment. Ten C. C. C. enrollees from this camp have been hired as tractor operators by contractors on Utah construction projects at the prevailing wage in that vicinity, and five others have been employed by the Bureau of Reclamation in a similar capacity.

Illustrating the second class of benefit are the enrollees employed as clerks in the E. C. W. camps. The operation of an E. C. W. camp involves considerable clerical and accounting work in keeping records of the funds expended, the work done, the materials, supplies, and equipment used, and the personnel papers of several hundred men. As a training school for young men interested in this field of endeavor, it is unexcelled, and the cost-accounting system, which was inaugurated with the 1937 fiscal year to record the expenditure of the Bureau's E. C. W. funds, should prove a fine experience for those enrollees who can qualify.

During his 6-month enrollment, an enrollee may be honorably discharged from the C. C. C., other than for physical disability, if he has been successful in obtaining a position, is urgently needed at home, or is returning to school.

The camp enrollment records indicate that ordinarily the enrollees on leaving the C. C. C. to accept positions return to their own States and localities. Of the eastern boys assigned to western camps, nearly all return to the East in securing positions, and western boys prefer to remain in the West. This is largely accounted for by the fact that a C. C. C. enrollee, when honorably discharged, is returned to his place of enrollment at Government expense if he so desires, and also probably to a considerable extent by the natural inclination of boys of enrollee age to return to their homes and families.

The E. C. W. camps located on the reclamation projects are engaged in necessary and urgent rehabilitation activities seeking to improve the conservation of the West's vital natural resource—water. The many varied types of reclamation construction work being done by the C. C. C. enrollees of these camps in the performance of their duties provide an essential job training for future employment.

Erratum

In the group of pictures on page 21 of the January issue of the Era, illustrating the article on the opposite page, "C. C. C. Accomplishments in Reclamation Projects", it will be noted that the titles of the Apache and Midview dams were reversed.

A 40-ACRE farm southwest of Paul, Minidoka project, sold in December for $2,750, and an 80-acre tract in the Pioneer district was disposed of for $8,400.

C. C. C. ENROLLEES LEARNING CONCRETE WORK ON LATERAL LINING—CAMP BR-53, NORTH PLATTE PROJECT, NEBRASKA

Why the Engineer?

Digest of an Address Delivered by Dr. William F. Durand at the Third World Power Conference Held in Washington, D. C., in September 1936 [1]

BECAUSE the engineer comes so close to the sources of the problems due to material advances of recent times, Dr. Durand challenges the profession with the statement that "we [engineers] cannot evade the responsibility which rests upon us to take our due share, even the lead, in the study of the problems which our own activities have, in a large measure, developed."

The engineer is concerned not only with inanimate materials and inorganic energies, but also with human agencies. The use of constructive materials and energies of nature result in a gradual and continual loss, the only exception being the energy derived from falling water, the source of which reaches beyond the earth to the heat radiated by the sun. The engineers are responsible to society at large and future generations for the wise and economic use of the materials of nature which are our present sources of supply, and must take part in the education of the public as to the problems of waste in the use of these materials.

The cooperative work of the scientists and engineers has made a new material world which calls for human readjustments and the wise use of the new products of science and engineering. The changed environment has brought new social, economic, political and international problems; for example, shifts in employment due to the increased use of machinery, concentration of populations, the new methods of warfare.

In conclusion, Dr. Durand stated: "What I am urging is a quickened sense on the part of the engineer of his responsibilities, not alone in a purely professional sense, but as a citizen of his community, of his State, of his country, of the world; a responsibility in the fulfillment of which he will take such part as he may in the earnest study of social, economic, and political problems, and in particular of the special conditions which his own activities have brought about, to the end that we may attain some better condition of balance as between the material content of our present-day civilization and the uses which we are making of it."—*G. L. Whitney.*

[1] The full text of the address was carried in "Electrical Engineering", December 1936, vol. 55, no. 12, pp. 1301–1303.

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Excerpts from December 1936 Project Reports

Orland.—With the exception of olives to be harvested for oil and a few Valencia oranges, all crops had been harvested at the end of the month. Prices for hay and grain were the highest for years. The local feed stores quoted $25 per ton for baled alfalfa. The amount of hay raised on the project is insufficient to fill the requirements of the local dairymen. Grain prices all showed an advance.

Milk River.—Winter range conditions were about normal, but little livestock remains upon the open range. Conditions were favorable for feeding upon the project and stock generally is in good condition. Sheep, especially lambs which are being fed on the project, made good gains, and returns from December shipments were good. The small grain market advanced considerably during the month, but there were no shipments, as all of these products remaining will be required for local consumption. The potato market continued good and shipments were unusually heavy. The market for fat cattle continued good, but there were practically no shipments of finished animals. A good price was received for fat lambs and shipments were fairly heavy, especially for the holiday trade.

Yuma.—Harvest of winter lettuce continued all month with 140 crates per acre as the average yield. Cabbage harvesting was begun with a forecast for excellent yields of high quality. Carrots and onions were doing well at the close of the month.

Pine River.—Prospects for crops are exceptionally good owing to heavy snows in the mountainous regions. Market prices were very good with a slight increase in quotations on all grains and potatoes.

Minidoka.—A preliminary crop report for the South Side pumping division for the year 1936 was prepared by the Burley irrigation district. It shows an average crop value of $43.76 per acre, with a total value of $1,885,156, which is more than 40 percent above the 1935 figures. The chief increases were in the returns from sugar beets and potatoes.

Rio Grande.—Young alfalfa, small grains, and beet-seed crops continued in a very satisfactory manner throughout the month. The preliminary report shows a total of 98,415 bales of cotton produced from 81,345 acres, which is the highest in the history of the project, and the second highest yield per acre. Gross returns on this crop, including the seed which brought an unusually high price this year, would be about 95 percent per acre. This crop constituted 59 percent of the cropped area.

Shoshone.—A few Great Northern beans are being sold for as high as $6 per hundredweight. These are being purchased by local seed buyers and will be sold in the spring for seed. It is estimated that the shipments of beans, beets, potatoes, hay, and sheep from the Powell station during the past 4 months represent a return of $1,144,000, which exceeds any year since 1919. Beans alone probably represent more than a million-dollar crop on the Powell flat this year as a considerable amount of them still remain unmarketed.

Grand Valley.—A total crop value in 1936 of $762,086, with a per acre value of $44.99, was reported. This represents an increase of approximately $300,000 over the 1935 valuation. Alfalfa hay, beans, and potatoes alone comprise $506,550 of the above figure.

Huntley.—The sugar-beet harvest was practically completed in October. Beet tops were more generally piled in the year 1936 and hauled to the feed lot for feed instead of being left on the ground and pastured with livestock. There is less waste in this method of handling.

THE local United States Reemployment Service on the Carlsbad project, New Mexico, has been active in placing unemployed labor on local and various construction jobs. The State office for the relief of indigents has been in operation recently.

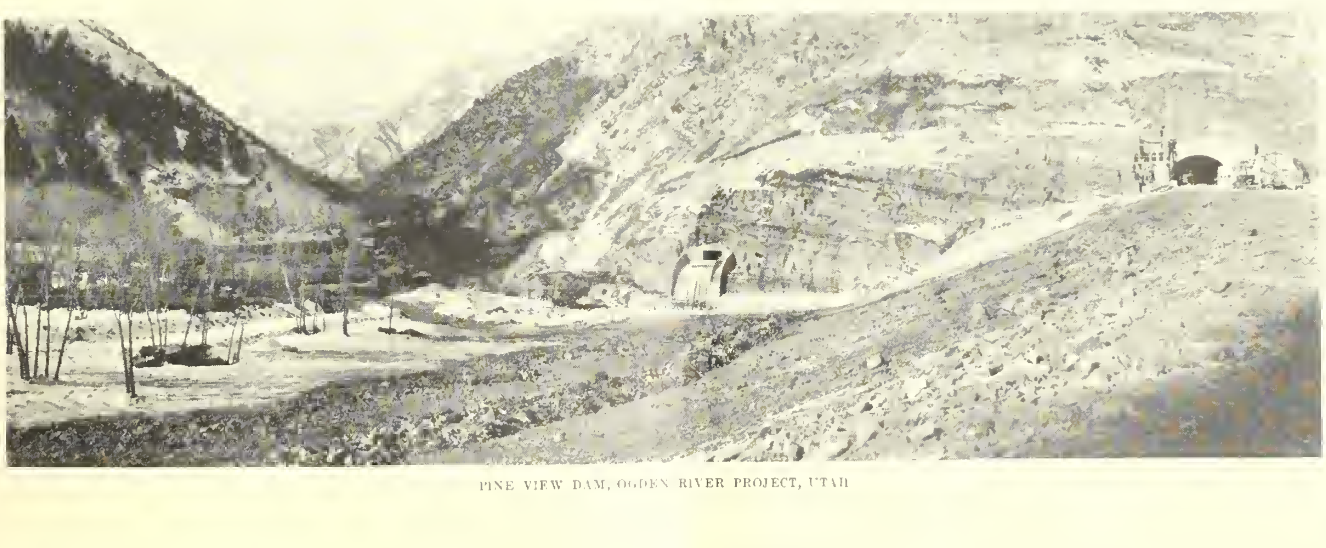
Federal Reclamation Laws

A new edition of the Federal Reclamation Laws, Annotated, to July 1, 1936, is now being printed and will be available for purchase shortly. Requisitions are now being received for the same and should be addressed to the Commissioner, Bureau of Reclamation, Department of the Interior, Washington, D. C. Prices are as follows:

Cloth bound edition	$1.50
Paper bound edition	1.25
Yearly supplement	.25

FOR this time of the year labor conditions on the Klamath project, Oregon-California, are better than they have been since 1930. All mills are operating and most of the large operators announced a 10-percent increase in wages effective January 1, 1937.

LOCAL industrial plants in and near El Paso, Tex. (Rio Grande project), have reported increases in employment and further anticipated increases in employment early this year.



PINE VIEW DAM, OGDEN RIVER PROJECT, UTAH

Notes for Contractors

Specification no.	Bid opened	Project	Work or material	Low bidder: Name	Low bidder: Address	Bid	Terms	Contract awarded
846-D	*1936* Oct. 22	All-American Canal, Ariz.-Calif.	Radial gates for Imperial Dam and Gila Valley Canal headworks.	Pacific Iron & Steel Co., Ltd.	Los Angeles, Calif.	$27,927.00	Item 1, f. o. b. Lynwood.	Dec. 30, 1936
				do	do	8,930.00	Item 2, f. o. b. Lynwood.	Do.
				Berkeley Steel Construction Co.	Berkeley, Calif.	18,500.00	Item 3, f. o. b. Berkeley.	Do.
703	Nov. 30	Boulder Canyon, Ariz.-Nev.	23,000-volt bus structure, generator neutral reactor, and generator voltage oil circuit breakers.	Westinghouse Electric & Mfg. Co.	East Pittsburgh, Pa.	108,450.00	Schedule 1	Jan. 12, 1937
				do	do	10,690.00	Schedule 2	Do.
				Allis Chalmers Mfg. Co.	Milwaukee, Wis.	122,673.00	Schedule 3	Do.
711	Dec. 14	Yakima-Roza, Wash.	Earthwork, canal lining and structures, Yakima Ridge canal, stations 102-198.	J. A. Terteling & Sons	Boise, Idaho	374,409.00		Jan. 4, 1937
856-D	Dec. 10	Sun River, Mont	Open drains, earthwork, and structures.	E. C. Powell	Missoula, Mont	21,798.00		Do.
857-D	Dec. 21	Yakima storage, Wash.	One 50-foot by 8-foot radial gate and hoist for Kachess spillway.	John W. Beam	Denver, Colo	1,075.00	Item 1	Jan. 6, 1937
				Pekrul Iron Works	do	1,575.00	Item 2	Do.

Progress of Investigations and Hydrology

Boulder Canyon project—Snow surveys, Arizona-California-Nevada.—Routine work was carried on in connection with the operation of precipitation stations within the Colorado River watershed. Conferences were held with representatives of other agencies to outline plans for the operation of the snow-survey courses during the coming season.

Central Valley project, California.—Water-supply studies were completed to determine the storage requirements and power possibilities with various combinations of reservoirs proposed for construction in the ultimate development of the water resources of the Sacramento River and its tributaries. A report on these features was prepared. A long-time reservoir operation study was subsequently made to determine the irrigation shortages.

Colorado-Big Thompson transmountain diversion, Colorado.—A reservoir operation study was made of the proposed Ranch Creek Reservoir to determine the storage required to meet irrigation and other requirements. Studies were made of the power available at the no. 4 power site on the Big Thompson River, utilizing water available in the river and also that proposed to be diverted from the Colorado River. A determination of the required replacement storage was in progress at the end of the month. Preliminary studies were based on two assumptions as to the amount of water which would be replaced, as follows: (*a*) replace the diverted water with storage water whenever the discharge at Glenwood Springs falls below the requirement of the Shoshone power plant of 1,250 second-feet, or (*b*) replace diverted water with storage water on the basis of present and future irrigation requirements at Palisades. The results of these preliminary studies were used at conferences between the project interests and the western slope interests, in an effort to arrive at some agreement on the amount of replacement storage which would need be provided within the Colorado River Basin in connection with the proposed transmountain diversion.

Eastern slope surveys, Colorado.—The entire eastern portion of the State has been covered with preliminary reconnaissance surveys where county commissioners, county agents, and others, have been contacted in connection with the proposed projects. On December 23, 1936, a meeting was held in the Bureau offices with representatives of the State planning board and other interested agencies, for the purpose of discussing the various projects.

Western slope surveys, Colorado.—Water supply studies were carried on which consisted chiefly of reconstructing the virgin flow of the Yampa River for the period of record, determining the contribution of each of the tributaries and parts of the basin, and dividing the irrigated areas into districts for a study of return flow and irrigation demand.

Rio Grande Basin investigations, Colorado-New Mexico.—(*a*) *Animas-Rio Grande diversion.*—The variation of unit run-off with altitude was studied, the water available for diversion was determined, and an operation study of this reservoir was made. The long-time water supply situation was depicted by means of 10-year progressive means. (*b*) *Weminuche Pass diversion.*—Water supply studies are in progress, following the same general plan as for the Animas-Rio Grande diversion. (*c*) *San Juan-Chama diversion.*—Area and capacity data were computed for the Boulder Lake terminal reservoir site.

Gallatin Valley, Mont.—In connection with the preliminary report on these investigations, data on past uses and deficiencies by the present canals were compiled and tabulated. A preliminary report, covering the water supply features of the project was prepared.

Black Hills, S. Dak.—The Denver office work for the month consisted of making water-supply studies to determine irrigation requirements, storage capacity required, and possible power output on the Angostura project, and in drafting a report thereon.

Colorado River, Tex.—A study was made of the effect of silting on the Marshall Ford Reservoir. Reservoir operation studies to determine power output at the proposed Marshall Ford Dam in combination with the Buchanan Dam, were made. The studies involved consideration of both the low and high dams at Marshall Ford. The assumed conditions were, in general, similar to those of previous studies. Report on the hydrology of the Colorado River was completed.

Reclamation Organization Activities and Project Visitors

John C. Page, Commissioner of Reclamation, made a short talk, illustrated with lantern slides, at Shepherd School, Washington, on January 11. Mr. Page also showed the Columbia Basin 2-reel film. The meeting was organized by the fathers of the Parent-Teacher Association and Mr. Page was invited by the program committee to be present and address the group.

Floyd I. Hagie, of Yakima, Wash., has been named acting executive secretary of the National Reclamation Association, with headquarters in Washington, D. C. for a few months. Mr. Hagie arrived in Washington on January 12.

Hon. Carl Hayden, United States Senator from Arizona, recently visited the All-American Canal and the Gila Valley projects, inspecting the work in progress. He also visited the irrigated areas on the Yuma Mesa and Valley division of the Yuma project.

Olaf Lauregaard, general office engineer, Tennessee Valley Authority, Knoxville, Tenn., and formerly construction engineer for the Bureau at Parker Dam, was a visitor on the Yuma project during the Christmas holidays.

Brower Fitts, who served as camp superintendent at E. C. W. Camp BR–49, Clear Creek, Wash., during 1936, died on December 20 at his home in Sunnyside. Mr. Fitts is survived by his widow and three children.

Among the recent visitors to the Truckee Storage Project, Nev., were the following: I. L. Williamson, vocational specialist for the Civilian Conservation Corps, in connection with the reclamation camps; J. R. Alexander, district counsel, Salt Lake City, Utah; and E. B. Debler, hydraulic engineer, Denver, Colo.

On January 6, 1937, the Department approved request from the Puerto Rican Reconstruction Administration for the services of John L. Savage, chief designing engineer of this Bureau, Denver, Colo., as a member of a consulting board for the Administration's hydroelectric program. Mr. Savage plans to make part of the trip by airplane to San Juan, P. R.

Joseph C. Gawler, 1859–1936

Joseph C. Gawler, who for many years had been identified with the Yakima project organization as fiscal agent, passed away at his home in Yakima, Wash., on December 15, 1936. His death occurred after a brief illness, which culminated in pneumonia.

Mr. Gawler, who was born on December 22, 1859, first began his employment in the service of the Government as a speech folder at the United States Capitol, Washington, D. C., on May 18, 1877. Later on he was employed in the Government Printing Office and continued in this work until about the year 1900. Shortly thereafter he accepted a position in the United States Reclamation Service. His employment in this Service was practically continuous until December 21, 1929, at which time, having attained the age of 70 years, he was retired, after more than 45 years of Government service.

Surviving Mr. Gawler, are his widow, Mrs. Jean K. Gawler, and a wide circle of friends, by whom he will be sorely missed.

Fred J. Berberick, of the Accounting Division, Washington office, is receiving congratulations on his marriage to Miss Hester Estelle Brophy, of Teaneck, N. J. (Mr. Berberick's home town), and Frostburg, Md. The ceremony was performed in Washington, D. C., on January 6.

B. E. Hayden, field supervisor in charge of district no. 5, visited the Carlsbad project the latter part of December and inspected several laterals and drains in connection with the proposed concrete lining program.

Mrs. Frank E. Weymouth Dies

Mrs. Maude Lane Weymouth, wife of F. E. Weymouth, former chief engineer of the Bureau of Reclamation, passed away at a New Orleans hospital on January 2. Mrs. Weymouth was en route with Mr. Weymouth to Washington, D. C., when she was stricken on the train before reaching New Orleans. She rallied temporarily, but pneumonia followed a relapse, which resulted in her death.

Mr. and Mrs. Weymouth (formerly Miss Mary Maude Lane) were married December 2, 1900, in Orono, Maine, after which she accompanied her husband on his many engineering posts throughout the United States and Mexico. They have lived in Los Angeles since 1929, when Mr. Weymouth assumed the duties of chief engineer of the Colorado River Aqueduct project. Mrs. Weymouth was buried in that city.

Joseph P. Shane, of Reno, Nev., has been appointed a clerk in the city manager's office, Boulder Canyon project, Boulder City, Nev. He entered on duty December 29.

Kenneth H. Talbot has been appointed for assignment to the Colorado River project, Tex., as associate (concrete) engineer at Marshall Ford dam.

C. M. Day Dies in Denver

As we go to press news has been received of the death in Denver on January 20 of C. M. Day, chief mechanical engineer of the Bureau of Reclamation.

As stated by Mr. Page, Commissioner, "Mr. Day was a veteran employee in the Bureau of Reclamation, having entered the service in 1906. He was the outstanding authority on the mechanical features of gates, valves, and other irrigation structures. Mr. Day's experience in the design of high-pressure reservoir outlet valves extended throughout the full period of the development of these appliances, and the excellent design of our present day needle valve, as exemplified by those installed at Boulder Dam, is principally due to Mr. Day's effective work."

A more complete account of Mr. Day's connection with the Bureau will be carried in the March issue of the Era.

The Secretary of the Interior has approved the following transfers to the Denver office: Uno V. Engstrom, junior engineer, from the Salt Lake Basin project, Provo, Utah; Louis Galloway, chief of field party, from the Moon Lake project, Duchesne, Utah; Stanley Kebbe has been transferred temporarily from the Burnt River project, Oreg., to the Denver office laboratory; William Killmore, assistant engineer, from Taylor Park Dam, Uncompahgre project; Donald S. Walter, engineer, from the Grand Coulee Dam, Columbia Basin project, Wash.; William D. Wood, associate engineer, from the Grand Coulee Dam, Columbia Basin project, Wash.

The Secretary of the Interior has approved the following transfers from the Denver office to the designated projects: L. Rees Brooks, junior engineer, to the position of assistant engineer, Bull Lake Dam, Riverton project, Wyoming; Howard W. Jackson, assistant clerk, to the Central Valley project, Friant, California, vice Samuel W. Cooper; James H. Knights, assistant engineer, to the Heart Mountain division, Shoshone project, Cody, Wyo.; Kenneth M. Westering, senior clerk, to the Central Valley project; Gilbert L. Yetter, engineer, to Los Angeles, Calif.

Other transfers approved by the Secretary are as follows:

Dean C. Allison, inspector at Taylor Park Reservoir, to the Uncompahgre project proper with headquarters at Montrose, Colo.

Harold M. Crowell, inspector, from the Moon Lake project, Duchesne, Utah, to the Salt River project, Phoenix, Ariz.

Horace V. Hubbell, engineer on the Ogden River project, to the position of construction engineer at the Fresno Dam, Milk River project.

Ceylon P. Humphreys and Arthur L. Gray, inspectors on the Ogden River project, to the Colorado River project, Texas.

Franklin MacMurphy, assistant geologist, Central Valley project, Friant, Calif., to the position of associate geologist, Seminoe Dam, Casper-Alcova project.

Tom C. Mead, associate engineer, from the Ogden River project, Ogden, Utah, to the Boulder Canyon project, Boulder City, Nev.

Homer H. Mills, inspector on the Boulder Canyon project to the Colorado River project, Texas, effective December 30.

Victor H. Pinneo, diamond drill foreman, from Colorado Big Thompson project, Granby, Colo., to the Alcova Dam, Casper-Alcova project, Wyoming.

Earnest Puckett, assistant engineer, from Ogden River project, Ogden, Utah, to the Contra Costa division of the Central Valley project, Antioch, Calif.

Rufus C. Thaxton, engineer, from Boulder Canyon to Central Valley.

Paul Whipple, and John F. Ball, diamond drillers, from the Colorado Big Thompson project, Granby, Colo., to the Alcova Dam, Casper-Alcova project, Wyoming.

S. Rothbard, counsel, assigned to the Washington office of the Bureau of Reclamation, was admitted to practice in the Supreme Court of the United States on January 12, 1937. The motion for the admission of Mr. Rothbard was made by Senator William H. King, of Utah.

Porter J. Preston, senior engineer, Bureau of Reclamation, in charge of the Colorado River Basin and Colorado-Big Thompson projects, was present at the recent annual meeting in Cheyenne of the Wyoming Reclamation Association and delivered an address, January 21, on "The Economic and Engineering Features of the Colorado-Big Thompson Project."

Miss Grace N. Conant, formerly connected with the Accounting Division of the Bureau of Reclamation, resigned at at the close of December 31, 1936, and is now employed in the office of Hon. Charles Kramer, Representative in Congress from California.

Fred J. Haas has been appointed by the board of directors of the Bard Irrigation District, Reservation Division, Yuma project, as secretary to succeed David N. Dow, who has leased his land in the Reservation Division and plans to spend the next few years in Oregon.

MORE than a thousand dairymen in the Yakima Valley participated in a $14,465 dividend made during the month of December by the Yakima Dairymen's Association. An average return of 33½ cents a pound for butterfat was received during the past year, as compared with 28 cents a pound in 1935.

MANY inquiries concerning Rio Grande project land continue to be received at the project office. There is an unusually high demand for these lands in spite of the fact that prices are increasing almost daily.

Charles R. Trowbridge Dies

Charles Russell Trowbridge, first superintendent of Rocky Mountain National Park and 35 years in Government service, died January 6 at his home in Denver, Colo., having succumbed to a heart attack.

Mr. Trowbridge was born March 8, 1865, in St. Paul, Minn. Enlisting in the Spanish-American War in 1898, he was sent with the United States troops to the Philippine Islands when insurrection broke out there, and he saw the American flag raised over Manila. At the close of hostilities, Mr. Trowbridge was named chief of the secret service of the city of Manila, a position he held until his appointment in 1913 as field representative of the Secretary of the Interior. It was in this capacity that he was sent to Estes Park in 1915 to organize the administration of Rocky Mountain National Park. This mission accomplished, Mr. Trowbridge remained in the field as contact man for the Department of the Interior until his retirement in 1933. In this capacity Mr. Trowbridge came in frequent contact with a number of our field offices as he fulfilled his duties as Department inspector.

WITH a view to aiding newcomers of limited means from drought areas, a group of Yakima ranchers, business men, and social workers, sponsored by the Yakima Chamber of Commerce, have undertaken to work out a program to aid in settling these people on small tracts.

CONSTRUCTION of the new $125,000 post office building at Sunnyside, Wash. (Yakima project), has been started. The second floor of this building is understood to provide new headquarters for the operation and maintenance organization of the Sunnyside division.

THE influx of land seekers on the Owyhee project, Oregon-Idaho, continues to be as heavy as at any time since the work on settlement of project lands was started. On December 19 and 21 eight new settlers were located on project lands by the Vale-Owyhee Land Settlement Board.

FAIRFIELD, Mont. (Sun River project) is one of the few towns in the State that has shown a persistent growth during the past 5 years.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation **John C. Page**, Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S Stuver, Asst. Gen. Supr. of Operation and Maintenance; A. R. Golzé, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal[1]	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant[1]	Boulder City, Nev.	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Ft. Sumner, N. Mex.	Wilfred W. Baker	Engineer		do	Do.
Casper Alcova	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voyen	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer		do	Do.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do	Do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do	E. E. Chabnt	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont.	H. V. Hubbell	Constr. engr.	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin[2]	Acting supt.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	F. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam[3]	Parker Dam, Calif.	E. A. Moritz	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif
Pine River Dam	Bayfield, Colo.	Charles A. Burns	do		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex.	L. R. Fiock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	S. F. Crecelius	Constr. engr.		do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. C. Koppen	Constr. engr.	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
Shoshone	Powell, Wyo.	L. J. Windle[2]	Superintendent	L. J. Windle[2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Reno, Nev.	L. J. Foster	Constr. engr.	Geo. B. Snow	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do	do	Do.
Upper Snake River Storage[4]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash.	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza div	do	Chas. E. Crownover	Constr. engr.	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Nohle O. Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting. [3] Non-Federal. [4] Island Park and Grassy Lake dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

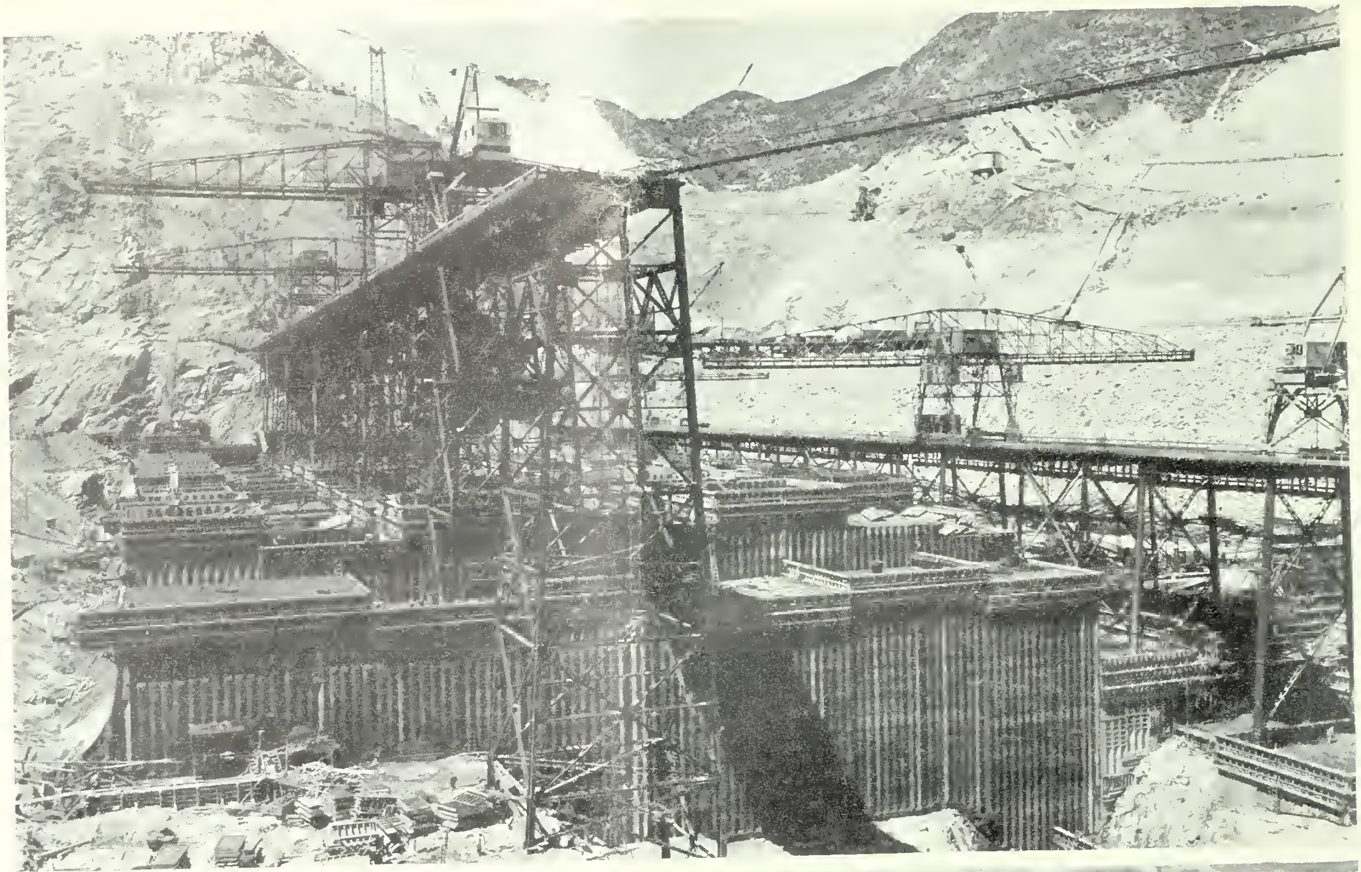
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M. Watson	Caldwell.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormich	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A.	Wellsville, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr.	President	Dorothy Eyers	Do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook division[1]	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do	Mary Harrach	Torrington
Northport division	Northport irrigation district	Northpnrt, Nebr.	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	Superintendent	D. D. Haris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	do	F. C. Henshaw	Phoenix.
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Geo. W. Atkins	Powell.
Frannie division	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotegut	President	E. G. Breeze	Payson.
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West division	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager	G. L. Sterling	Ellensburg.

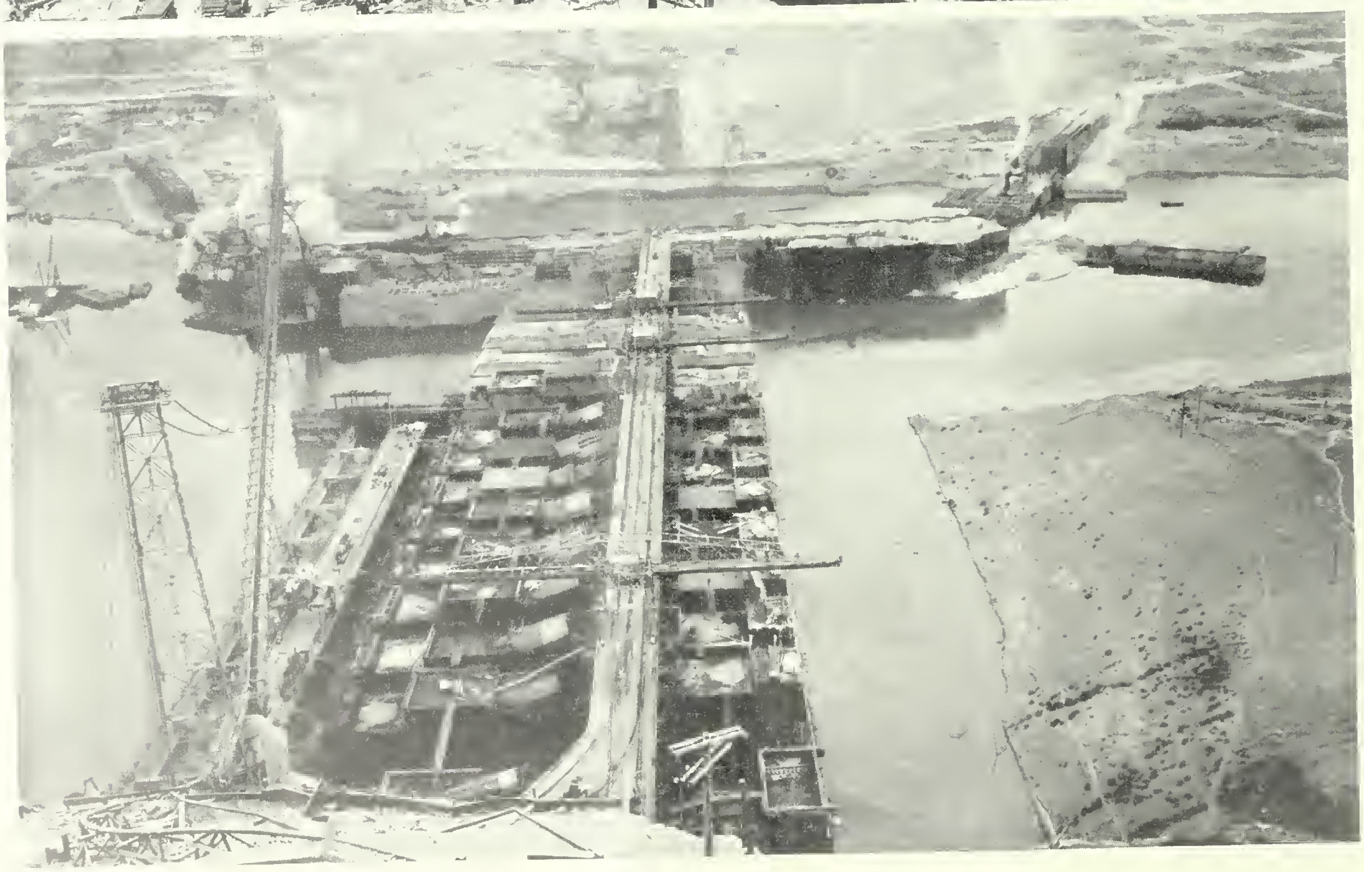
[1] Operated by 5 irrigation districts.

Important invcstigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo.	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo.	Frank C. Merriell	Do.
Black Hills	Rapid City, S. Dak.	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	Denver, Colo.	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Engineer.
Conchas	Tucumcari, N. Mex.	J. A. Keimig	Associate Engineer.

SALLIE A. B. COE, *Editor.*





COLUMBIA BASIN PROJECT, WASHINGTON (SEE ART. ON P. 30)

TOP: LOOKING WEST ACROSS GRAND COULEE DAM.

BOTTOM: THE COLUMBIA RIVER HAS BEEN DIVERTED TO FLOW THROUGH FOUR SLOTS LEFT IN THE WEST SECTION OF THE DAM. THE DOWNSTREAM CROSS-RIVER COFFERDAM AT LEFT HAS BEEN CLOSED, AND THE UPSTREAM CROSS-RIVER DAM AT RIGHT IS APPROACHING COMPLETION. MORE THAN 1,750,000 CUBIC YARDS OF CONCRETE HAVE BEEN POURED IN THE WESTERN SECTION, AND POURING HAS BEGUN IN THE EAST EXCAVATION SEEN IN THE DISTANCE DIRECTLY ACROSS THE RIVER.

THE
RECLAMATION ERA

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GRAND COULEE DAM SITE, COLUMBIA BASIN PROJECT, WASHINGTON

MONTHLY MAGAZINE OF THE BUREAU OF RECLAMATION, UNITED STATES DEPARTMENT OF THE INTERIOR

"3 Years of P.W.A."

It may justly be claimed that P. W. A. has been of great advantage to the communities in which projects have been built. While, of course, we have always regarded any project on which the Government has loaned money or to which it had made a grant as the enterprise of the city or county or State that was building it, nevertheless, as a protection to our investment, we have exercised the right to see to it that the project was being constructed strictly in accordance with the specifications. By working in friendly cooperation with the local authorities we have educated them, in very many instances, in improved methods of building. I wonder how many communities there now are that have learned better construction methods on their public works; that know that projects can be built more quickly than they had been built in the past; and, more important still, that have acquired the knowledge that public works can be put up as efficiently, as honestly, and as graftlessly as a private undertaking.

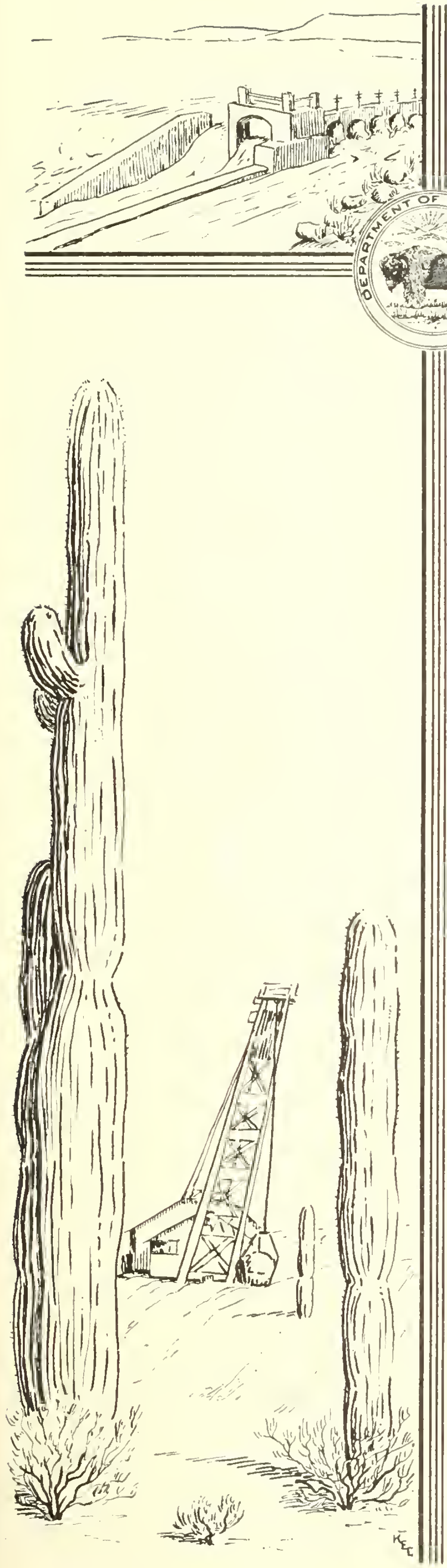
As an effective means of giving work to the unemployed and as a potent instrumentality in recovery, the Public Works program has fully justified itself. It has meant work for hundreds of thousands of men in every part of the United States.

I believe that such a program of public works as we have been engaged upon has fully justified itself as a most effective weapon in a war on depression. I am convinced that the country realizes this, and that appreciation of what we have done will grow with the years. P. W. A. has established precedents and has set patterns. I would be the last to claim perfection for it, but at least, as the result of our hard-won experience, the country is in a position to undertake much more quickly, and even more efficiently, than did we, a public-works program of a similar sort if occasion should arise again. Not to be prepared to fight a depression with all known and tested instrumentalities is just as criminally stupid as it would be not to be prepared if war should invade our country.

The fires under the boilers of P. W. A. as an engine of national recovery may be banked but they must never be drawn. The thousands of useful, permanent public works, serving as many communities, stand as permanent monuments to what the Government, in cooperation with the contractors of America, has contributed to overcoming the depression and form a solid foundation upon which to build a great new department.

In a sense my address to you 4 years ago was my salutatory as Public Works Administrator. Tonight in giving an accounting of my trusteeship before those whose help made the fine record of P. W. A. possible, I am pronouncing a valedictory of a sort. If and when favorable action is taken by the Congress, on the suggestion of President Roosevelt, that a Department of Public Works be established as a recognized major agency of Government, a new path into the future will have been blazed. In facing that future you are entitled to the consciousness that in doing a good and worth-while job as contractors under the President's emergency program, you were doing a good and worth-while job as citizens of the United States.

—Excerpts from address delivered by Secretary of the Interior Harold L. Ickes before the Associated General Contractors of America at their annual convention in San Antonio, Tex., February 17, 1937.



THE RECLAMATION ERA

PRICE 75 CENTS A YEAR

HAROLD L. ICKES
SECRETARY OF THE INTERIOR

JOHN C. PAGE
COMMISSIONER, BUREAU OF RECLAMATION

CONTENTS

The committee included in its recommended lists for detailed investigation, for immediate construction, and for delayed construction projects in which the Bureau of Reclamation is interested which will cost more than $500,000,000. Several of these projects are large long-range developments, completion of which will require 10 to 50 years. Enough projects to make up three-fourths of the total recommended expenditure fall into this class.

All of the projects upon which the Bureau now is working were included in the list. Few, if any, new projects, however, were added in the classification designed to constitute a reservoir to be drawn upon for immediate construction. Some new irrigation projects did appear in the section which contains those recommended for delayed construction.

The report recommended that $1,240,000 be made available for detailed investigation of four proposed irrigation projects. Twenty-six projects now under construction by the Bureau were recommended for immediate consideration and completion. These will involve expenditures of $335,548,000, although the annual expenditures probably will be in the neighborhood of only $50,000,000. Nineteen projects, including the irrigation development which is a part of the Grand Coulee Dam, Columbia Basin project, in the State of Washington, were placed in the delayed status. These would involve expenditures of $262,425,000.

As construction advances, and if the report of the Water Resources Committee is revised from time to time and brought up to date, it will be logical to expect this group of projects now in a delayed status to advance to a higher group for consideration in connection with the program for immediate construction.

Since 1902, when the Federal Reclamation law was enacted, the United States Bureau of Reclamation has been the principal agency at work in the West in the irrigation field. Prior to that time nearly all of the simple and easy irrigation developments had been undertaken. Those remaining were complex, presenting more difficult engineering problems and calling for more expensive works. During the life of the Bureau of Reclamation, these projects have been growing increasingly complex. They now almost universally require conservation of water heretofore wasted into the sea. The reason for this is obvious. The water supply of this western area is severely limited by nature. We have been approaching at a fairly rapid rate the time at which no water will remain unused. Speaking broadly, few projects now remain which do not include control of entire rivers.

RECLAMATION DAMS—MULTIPLE-PURPOSE DEVELOPMENTS

One such project already has been completed. Boulder Dam in Black Canyon in the Colorado River has harnessed that dangerous stream and changed its character completely over a long section of its course. The Boulder Dam cost about $114,000,000. It presented a welter of new and difficult engineering problems, but the service rendered by this project completely justifies the expenditure and the effort. By careful planning, Boulder Dam is made to conserve water for more different and diversified benefits and uses than any other similar project so far constructed. It regulates an erratic stream for the control of floods and the provision of a reliable water supply for irrigators and cities downstream. It will generate sufficient hydroelectric energy to repay its entire cost and provide a surplus. Already four 115,000-horsepower generators are in operation in the Boulder Dam power house. In addition, Lake Mead, the world's largest artificial lake, has been created and a new and valuable recreation area provided in a section where this was badly needed.

Boulder Dam is an example of the new type of western water project. Others of these multiple-purpose developments are in construction. In the future most of the major reclamation projections in the West will be of this general type.

These projects fit admirably into a national plan for control and conservation of waters. They are adapted to meet the immediate needs of a locality, they are self-liquidating, and they serve the national purpose through stabilization of insecure communities and through markedly increasing the national wealth.

RECLAMATION'S CONSTRUCTION PROGRAM

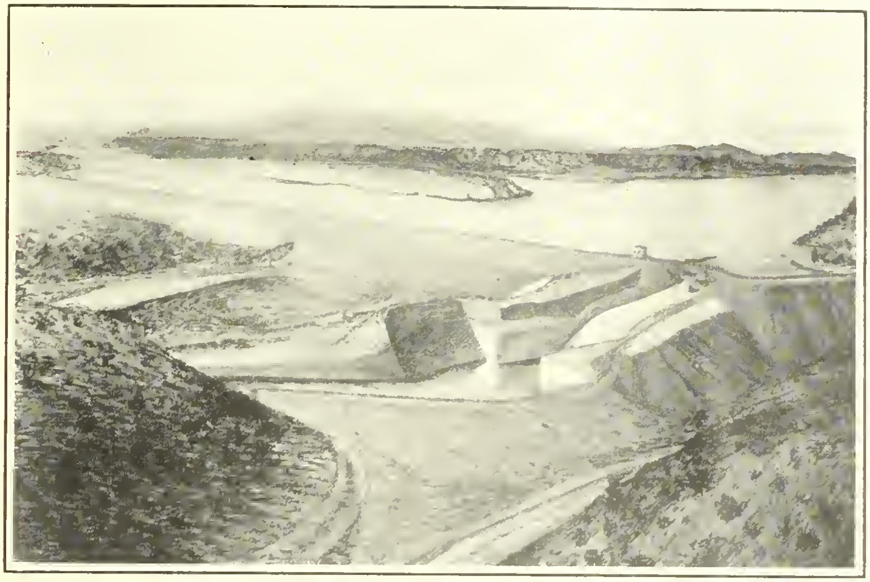
The Bureau of Reclamation now is engaged in its largest construction program. Seventy-two construction contracts of a total value of $87,863,000 now are in force. When the projects now in construction are completed, the usable storage capacity in Bureau of Reclamation reservoirs will be increased to 56,610,000 acre-feet. These reservoirs then will hold enough water to cover all New England to a depth of almost 18 inches. Conservation of this amount of water in the arid and semiarid West is of immeasurable advantage.

Records of the Bureau of Reclamation show that wealth produced from its projects annually approaches the total capital outlay involved in their construction. In addition to tangible and immediate results, the intangible benefits are reflected through the social scale. Transportation and communication facilities are strengthened. Railroads freight manufactured articles to the western farmers and carry in return their specialty products to eastern markets. Important markets are provided for the industrial centers. School, county, city, State, and the National Governments are bulwarked by the addition of prosperous new communities. Western cities, which have outstripped in growth the development of their agricultural hinterlands, are provided with a more secure future.

The effect on a community of a well-planned water conservation project is illustrated by the Imperial Valley in California, where 500,000 acres are irrigated and a population of 65,000 persons makes its home. It was at the mercy of the Colorado River before Boulder Dam. Since the flood gates of Boulder Dam were closed in 1935, a new psychology is apparent in the Imperial Valley. A sense of security pervades there and it is reflected in the business and agriculture of the entire area. The danger of inundation of this below-sea-level valley and the corollary threat of drought both have been removed by regulation of the Colorado River. These benefits are not entirely intangible. In 1906 the Colorado broke its banks and all but destroyed the valley. Millions were spent in returning it to its course. Millions more went into the construction of a levee system, the maintenance of which required a heavy annual outlay. In 1934, just 1 year before Boulder Dam became operative, the flow of the Colorado River dwindled to a trickle and crops of an estimated value of $10,000,000 failed in the valley. When the All-American Canal is complete, and it is about half done at this time, an additional saving will accrue to the irrigators in Imperial Valley. These farmers now spend in excess of $1,000,000 a year in cleaning silt from their ditches. The desilting works under construction at the head of the All-American Canal will reduce greatly or eliminate the necessity for this expenditure.

AN UNEXPECTED BENEFIT OF STORED WATER

The benefits which result from the conservation of water through storing it in reservoirs sometimes appear in unexpected ways. Here is an unusual example of such work. This winter severe cold gripped the intermountain region of the West. Small streams were frozen and the generating plants of power companies failed for lack of water. In the midst of this emergency, a hurried call came to the Bureau of Reclamation from power interests operating in two States saying that unless water stored in one of the Bureau of Reclamation reservoirs could be released to run the turbines in a certain power plant, there was immedi-



PERSPECTIVE DRAWING DEVELOPED FROM PLANS OF CABALLO DAM RIO GRANDE PROJECT, NEW MEXICO, BY WM. R. ORR, ENGINEERING DRAFTSMAN.

ate danger that the power output in those States would be insufficient to permit continuous operation of several major industries. More than 3,000 men were about to be thrown out of work. An order went forward to release the required water. The situation was saved. Without a backlog of stored water in this particular area, many would have suffered this winter.

The difficulties experienced by Salt Lake City a few years ago provide another illustration of the manner in which reclamation reservoirs can be used. The Salt Lake City water supply through a series of dry years proved to be inadequate. Proration was resorted to. During several summers the people were forbidden to water their lawns, and one of the most beautiful cities in the West was blighted. The Bureau of Reclamation now is preparing to construct a project by which irrigation supplies will be supplemented and from which Salt Lake City may obtain a sufficient and reliable water supply in future emergencies.

I have dealt here at some length with reclamation, because I am most familiar with this work. It is cited as one branch of the national problem of water conservation and control. Other sections similarly have individual needs, in many cases as serious. No section or locality is without such a problem.

This country has a tremendous job before it in the conservation and control of its waters, but it is not a task without compensations. Soundly planned and intelligently executed, the cost of a program such as that sketched in outline by the National Resources Committee will be repaid in greater security for ourselves and our children, and by new advances along the road of progress.

New Mexico Section A. S. C. E. Meets

The New Mexico section of the American Society of Civil Engineers elected its officers for 1937 at a meeting held in Albuquerque on December 15. The list is as follows: Frederic G. Healy, president; R. H. Rupkey, first vice president; Thomas McClure, second vice president; and William E. Strohm, secretary and treasurer. On September 11, 1936, the first regular fall meeting of the section took place at the University of New Mexico. At the session Frederic Healy, one of the directors of the section, gave an account of the annual convention of the society, which was held in Portland. The speaker of the evening was Raymond Hill, consulting engineer and director of the society, who discussed the mistakes involved in the design of the spillways of the Mormon Flats, Horse Mesa Dam, and Roosevelt Dam. At a meeting of the section held in Santa Fe on October 14 last, a talk was given by Harold Conkling, deputy State engineer of California. Mr. Conkling's subject, which was Administrative Control of Underground Water, elicited enthusiastic discussion. On November 9 Daniel W. Mead, then president of the society, was entertained at a banquet given by the section at the El Fidel Hotel. Dr. Mead was the speaker on this occasion, his subject being Engineering Ethics.—*Civil Engineering.*

THE unemployment situation in Carlsbad, N. Mex., and on the project is being well taken care of by the regular farm work and the P. W. A. beach project in Carlsbad and activities occasioned by the commencement of operation at the union potash location.

21 Projects See Slides on Irrigation Agriculture

The illustrated lecture, New Ideas in Irrigation Agriculture, consisting of 56 slides in natural color and valuable data on irrigation farming, has been scheduled for showings on 21 reclamation projects during January, February, and March.

The slides have been presented at meetings of water users, farm groups, civic organizations, commercial clubs, irrigation conferences, and schools. Special meetings featuring the slides have been arranged in public auditoriums, schoolhouses, and movie theaters of the projects and surrounding regions.

Severe snowstorms and the coldest weather on record for two decades handicapped many project programs, and in some instances meetings had to be canceled because the roads were impassible. In spite of the severe weather, over 100 farm groups have enjoyed the illustrated lecture during the past 3 months. Several projects are asking if the slides can be loaned again for additional programs in their community. Requests for the slides continue to come from farm groups, schools, and colleges.

A printed lecture, accompanying the slides, covers conservation of soil and water through better irrigation practices, new ideas in developing permanent pasture, suggestions for controlling and eradicating noxious weeds, and affords a pertinent program for farm groups during the spring season. The slides are available to groups interested in the development of better irrigation farming on request to J. C. Page, Commissioner, Bureau of Reclamation, Washington, D. C.

High Yields of Pima Cotton on Yuma Project

W. H. Cooch, pioneer rancher and cotton grower in the Bard district, reports very satisfactory returns from his 1936 cotton crop. From 20 acres of Pima long staple cotton, 8,868 pounds net lint were produced. Five bales were sold in October 1936 for 26.5 cents per pound, and remainder of the crop or 13 bales, topped the Phoenix market during the week ending January 23 at 32.5 cents. The average gross return per acre was $136.62.

For the 1935 season Mr. Cooch reported an average of 637 pounds net lint per acre from a 9-acre field of Pima cotton. This is one of the highest yields on record for this variety of cotton.—*Yuma Daily Sun.*

The Reclamation Era

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Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

MARCH 1937

Reclamation Recognition

Last month the National Resources Committee submitted to the President of the United States its report on public-works planning. This the President, in turn, submitted to Congress.

Recommendations are made that there be formulated a 6-year program of Federal construction of approved projects which were submitted to the Committee; that there be annual revision of such a program, and that revision and adoption of the submitted list of approved projects be made by Congress; that a lump-sum annual appropriation under regular budget procedures for expenditure on these projects be made by Congress, and that these funds be allocated to appropriate construction agencies by a permanent public-works or development agency. The projects included in the recommendations of the Committee to be either investigated or constructed are by no means a complete list of worthy projects but represent only those projects submitted to the Committee and approved by it. However, the provision for annual revision of the approved list of projects affords an opportunity for the submission of other worthy projects to the National Resources Committee for review.

The Committee personnel is as follows:

Harold L. Ickes, Secretary of the Interior, Chairman.
Harry H. Woodring, Secretary of War.
Henry A. Wallace, Secretary of Agriculture.
Daniel C. Roper, Secretary of Commerce.
Frances Perkins, Secretary of Labor.
Harry L. Hopkins, Works Progress Administrator.
Fredric A. Delano.
Charles E. Merriam.

RECLAMATION TERRITORY

Of especial interest to the Federal reclamation projects is the liberal recognition of the prominent place Federal reclamation must take in any water-conservation program. The detail of the report treated by drainage basins includes irrigation in both classifications of "investigation projects" and "construction projects." The official territory of the Bureau falls in the following drainage basins: Missouri, Southwest, Upper Rio Grande, Western Gulf, Colorado, the Great Basin, California, and Pacific Northwest.

These divisions were established by the National Resources Committee for convenience and each includes specific projects either for investigation or construction. The report makes no attempt to designate the methods of financing nor whether they are considered to be Federal or non-Federal undertakings.

A typical set-up in the Missouri Basin project list appears on the opposite page.

COORDINATING UNIT EFFECTIVE

From this it will be seen that a great amount of work has been accomplished in the field of orderly planning for the utilization of water resources. Much can be said in favor of the recommended review of projects to bring about the maximum benefit from the water resources. Such orderly planning is exemplified in the building of Boulder Dam, seven States being involved in the drainage basin. By advance planning and a correlation of data of all agencies, Boulder Dam is an accomplished fact. It disposes of what has been a very troublesome flood control problem, and with the completion of the All-American Canal, which carries Colorado River water from the Imperial Dam below Boulder Dam to the very fertile Imperial Valley, control of Colorado River water has been placed entirely within the United States.

The goal of preventing disastrous floods in dangerous flood territory and of storing flood waters, which would otherwise go to waste without beneficial use, is a national one. Every opportunity for the conservation of water in the Western States should be studied in connection with irrigation development in order to obtain the maximum national benefit from the limited water supply. For this purpose a coordinating unit is important.—*M. A. Schnurr.*

Colorado Section A. S. C. E. Holds Meeting

On December 14, 1936, the Colorado section of the American Society of Civil Engineers held its annual meeting, at which the following officers were elected for 1937: E. B. Debler, hydraulic engineer, Bureau of Reclamation, president; R. L. Downing, vice president; and P. S. Bailey, secretary-treasurer. The feature of the occasion was a talk by John H. A. Brahtz, engineer in charge of the photoelastic laboratory of the United States Bureau of Reclamation. Mr. Brahtz spoke on The Photoelastic Apparatus in Theory and Application, illustrating his talk with instruments and materials from the Bureau of Reclamation.—*Civil Engineering.*

WORK of constructing farm buildings by the Resettlement Administration on their project in the lower Grand Valley is progressing.

(Cut along this line)

COMMISSIONER, (Date) ____________

Bureau of Reclamation,
Washington, D. C.

SIR: I am enclosing my check[1] (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) ____________

(Address) ____________

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[1] Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Group A.—Project for immediate investigation or construction

[This table referred to in editorial]

	Estimated cost	Remarks
1. INVESTIGATION PROJECTS		
Missouri Basin, general:		
Irrigation: Investigation of small-scale projects in Great Plain area	$150,000	
Yellowstone:		
Irrigation: Yellowstone-Missouri-Snake diversion project	150,000	
General: Big Horn River Basin, plan of development	50,000	
2. CONSTRUCTION PROJECTS		
Missouri headwaters:		
Irrigation:		
Ackley Lake, Mont.: Increased water storage by raising natural outlet of lake, and to fill same by feed canal (5 miles long) from Judith River for irrigation supply.	98,000	Plans nearly ready.
Barber, Mont.: Outlet tunnel from Deadman's basin to return water to the river to supply lower Musselshell canals.	300,000	Inlet tunnel from Musselshell River under construction; sum needed to complete.
Durand, Forks, and Martinsdale, Mont.: Reservoirs for irrigation	400,000	Cost given is for first 2 years; additional needed to complete, $376,000.
Fairfield, Mont.: Sun River project canals and drains to complete system	400,000	Cost given is for first 2 years; additional needed to complete, $500,000.
Fort Belknap Indian Reservation, on Milk River, Mont.: Improvements to present irrigation system.	30,000	Storage in chain of lakes included with Milk River project; plans completed, cost given is for first 2 years, additional needed to complete, $30,000.
Madison County, Mont.: Storage reservoir on Ruby River for irrigation of lands in Ruby and Jefferson Valleys.	527,000	Plans completed.
Montana: Small reservoirs in several counties costing less than $25,000 each, for irrigation and grazing, including Little Dry Creek, Buffalo Hill, Ash Creek, and Clear Lake.	250,000	Plans are incomplete.
Saco, Mont.: Saco Divide pumping division of the Milk River project for irrigating 10,000 acres of land above gravity system.	400,000	Plans in preparation; cost given is for first 2 years; additional needed to complete, $600,000.
Upper Boulder, Mont.: Dam to provide supplemental storage for irrigation	200,000	
Irrigation and water supply:		
Fort Peck Indian Reservation, Mont.: Missouri River pumping plant for stabilizing supply for several units on reservation.	100,000	Cost given is for first 2 years; additional needed to complete, $100,000.
Jordan, Mont.: Big Dry Creek storage reservoir to be used in conjunction with Wolf Creek Reservoir for irrigation purposes. It would also serve town of Jordan.	80,000	Plans nearly ready.
Yellowstone:		
Irrigation:		
Big Horn and Powder River Basins, Mont.: Small reservoirs	200,000	Plans can be completed quickly.
Crow Indian Reservation, Mont.: Irrigation systems	300,000	Cost given is for first 2 years; additional needed to complete $200,000.
Gooseberry Reservoir, Wyo.: Storage	197,000	
Grass Creek Reservoir, Wyo.: Supplemental storage	100,000	
Heart Mountain Division, Shoshone project, Wyo.: Irrigation	4,500,000	Sum necessary to complete.
Louis Lake Reservoir, Wyo.: Supplemental storage	31,000	
Owl Creek, Wyo.: Irrigation district; supplemental supply	325,000	
Riverton irrigation project, Wyo	750,000	Cost given is for first 2 years, additional needed to complete, $3,100,000.
Shell irrigation project, Wyo.: Additional storage	55,000	
Sidney, Mont.: Pumping project	85,000	Plans nearly completed.
Tensleep Meadows Reservoir, Wyo.: Storage	48,000	
Tongue River, Mont.: Storage	820,000	Plans in progress.
Upper (Missouri) western tributaries:		
Irrigation:		
Carter County, Mont.:		
Storage on Box Elder Creek	67,000	Plans ready.
Little Missouri River: Storage and irrigation canals	778,000	Ready for contract.
Cheyenne:		
Irrigation: Niobrara and Weston Counties, Wyo.: Constructing 4 dams and reservoirs to provide storage of water for irrigation purposes.	25,000	Plans nearing completion.
Platte River:		
Irrigation and power: Casper-Alcova project, Wyo	2,000,000	Under construction; cost given is for next 2 years; additional needed to complete, $4,800,000.

Gopher Catching Contest—Cash Rewards Offered

By Henry Frauenfelder, President Yuma County Water Users' Association

AN OPPORTUNITY to earn some ready money is being offered by the Yuma County Water Users' Association to all the youngsters, both boys and girls, enrolled in the valley schools. Clifton Harkins, county school superintendent, realizing the benefit that will accrue to the farmers of this district and the value to the pupils of an experience in cooperation, has enthusiastically approved the contest.

Schools participating in the campaign are Gadsden, Somerton, Sunnyside, Rood, and Crane. To the boys or girls in each school catching the greatest number of gophers a prize of $5 will be given, to the ones accounting for the second greatest number a prize of $3.50, and to the ones ranking third a prize of $2. But that isn't all. In addition to the foregoing amounts, grand prizes of $5, $3.50, and $2 will be given to the three pupils ranking highest in the whole valley.

In order to keep up the interest of all the boys and girls throughout the two or more months of the contest, a bounty or reward of 2 cents will be paid for each and every gopher caught. This amount is guaranteed and has nothing to do with the prize money. The bounty of 2 cents per gopher will be paid every 2 weeks.

Mack Taylor, a specialist from the United States Biological Survey, will be in direct charge of this gopher-control campaign. He will not only be glad to give expert instruction to pupils in the best ways to set traps but will also call regularly two or three times each week at all valley schools to keep records of the number of gophers caught by each pupil. The tails of all gophers caught are to be turned over to Mr. Taylor who will at the end of every 2 weeks pay 2 cents per tail.

Farmers all over the valley are urged to take advantage of this opportunity to have their ranches trapped and freed of gophers. Several ranchers have already declared their intention of adding a few cents to the bounty offered by the Water Users' Association to encourage the boys and girls to thoroughly trap their farms.

The hardware stores of E. F. Sanguinetti and the I. V. Hardware Co. have generously offered to cooperate with the water users' association for the duration of this contest, selling the standard makes of gopher traps at cost price of $1.90 per dozen.

(Continued on p. 53)

Grand Coulee Construction Spreads Work Over 40 States

Cash registers in 40 States and the District of Columbia to December 31, 1936, were rung as $23,264,334.26 worth of equipment and materials was purchased for construction of Grand Coulee Dam, being built by the Bureau of Reclamation on the Columbia River in eastern Washington.

"The remarkable spread of off-the-site work provided by Boulder Dam is being equaled at this time in the construction of Grand Coulee Dam", Secretary of Interior Harold L. Ickes said in commenting on the report by the Bureau of Reclamation of purchases made by it and the principal contractor (Mason-Walsh-Atkinson-Kier Co.). "The thousands who have obtained employment at prevailing wages at Grand Coulee Dam these last 3 years have been only the advance guard of an army of men spread in a great fan in factories, forests, and mines, and on railroads completely across the continent.

"This army has been sending up materials for use at the dam, and their employment to that extent has been given by the construction of Grand Coulee Dam just as surely as if they had strung the cable they made or drove the steel piles they fabricated at the site itself."

Of the total cost of the construction to December 31, nearly two-thirds has gone into the production of off-the-site labor, for in addition to the $23,264,334.26 which has gone for equipment and materials, about $2,000,000 has been paid for freighting the purchases to the dam.

	Government	MWAK	Total
Ala.	$86,189.12	$1,000.00	$87,189.12
Ark.		456.38	456.38
Calif.	96,082.24	1,663,268.19	1,759,350.43
Colo.	96,929.40	48,257.88	145,187.28
Conn.	1,215.65	62,799.28	64,014.93
Del.		158,020.06	158,020.06
Dist. of Col.	31,888.96	59,917.06	91,806.02
Fla.		536.23	536.23
Ga.	40.80	2,008.02	2,048.82
Idaho	2,740.81	9,824.55	12,565.36
Ill.	188,439.03	1,653,325.14	1,841,764.17
Ind.	1,073,131.58	5,336.06	1,078,467.64
Iowa	11,393.66	150,899.62	162,293.28
Kans.	219.63	10.73	230.36
Ky.		7,960.07	7,960.07
La.		5.40	5.40
Maine		3,166.64	3,166.64
Md.	307.59	42,831.09	43,138.68
Mass.	5,112.48	112,856.49	117,968.97
Mich.	16,067.16	135,620.06	151,687.22
Minn.	29,890.75	473,718.31	503,609.06
Mo.	87,337.44	67,756.57	155,094.01
Mont.		51,498.24	51,498.24
Nebr.		179.00	179.00
Nev.	845.85	562.50	1,408.35
N. J.	94,358.47	702,218.50	796,576.97
N. Y.	212,850.90	1,297,464.82	1,510,315.72
N. H.		170.86	170.86
N. C.	1,147.77	1,800.00	2,947.77
Ohio	49,593.71	1,824,815.11	1,874,408.82
Oreg.	128,171.68	509,137.03	637,308.71
Pa.	59,650.32	1,159,143.43	1,218,793.75
R. I.	2,318.58	3,057.66	5,376.24
S. C.		2,000.00	2,000.00
Tenn.	415.51	201.71	617.22
Tex.		68.00	68.00
Utah	2,846.46	499.24	3,345.70
Va.	92.16	792.10	884.26
Wash.	4,480,042.85	6,021,088.37	10,501,131.22
W. Va.	28,983.74	6,183.53	35,167.27
Wis.	56,747.11	178,828.92	235,576.03
Total	6,845,051.41	16,419,282.85	23,264,334.26

The contractor has put $16,419,282.85 into purchase of equipment and supplies, according to figures presented to the Bureau of Reclamation, against $11,478,341.13 he has paid to employees working at the dam. The Bureau of Reclamation has expended $6,845,051.41 for materials. Expenditures made by less important contractors on the job have not been broken down here.

Almost half of the money which has gone for materials and supplies has been spent in States east of the Mississippi River. Expenditures of more than $1,000,000 have been made in seven States, California $1,759,350.43, Illinois $1,841,764.17, Indiana $1,078,467.64, New York $1,510,315.72, Ohio $1,874,408.82, Pennsylvania $1,218,793.75, and Washington $10,501,131.22. While the largest total appears for the State of Washington, in which the dam is being constructed, many of the purchases made there have been made through dealers. Much of this material is manufactured in other parts of the country. No attempt was made to trace these purchases beyond the dealer.

In addition purchases were made of more than $100,000 in 10 States, Colorado $145,187.28, Delaware $158,020.06, Iowa $162,293.28, Massachusetts $117,968.97, Michigan $151,687.22, Minnesota $503,609.06, Missouri $155,094.01, New Jersey $796,576.97, Oregon $637,308.71, and Wisconsin $235,576.03.

The States benefitting by this construction and the total amounts expended in each are listed in the accompanying table.

Progress of Investigations of Projects

Blue River transmountain, Colorado.—Surveys were in progress at the Empire Reservoir site on Clear Creek and on the canals from Clear Creek to the South Platte River and beyond. Horizontal control was being established for the entire system. Foundation explorations of the Green Mountain Dam site were continued with the excavation of test pits, tunnels, and shafts. Computation of reservoir areas and capacities and the preparation of geologic maps was in progress.

Colorado-Big Thompson, Colorado.—A summary was prepared during the month covering all the geological features of the project. The designs and cost estimates of the project were completed, water supply studies were continued, and a summary of the proposed report on the investigations was prepared and forwarded to the Washington office for review.

Eastern slope, Colorado: (a) Cherry Creek surveys.—Located east of Castle Rock, Colo. Topographic surveys were completed at the reservoir site, which is about 3½ miles southeast of and above the washed out Castlewood Dam. Topographic surveys of the dam-site were in progress at the end of the month. Water supply studies are in progress in the Denver office, to determine the amount of water available for storage at the above site.

(b) Hugo flood-control surveys.—Located on Big Sandy Creek about 5 miles southeast of Limon. Topographic surveys for an off-stream reservoir site and along the canal alinement for a proposed diversion of the entire flow of the creek have been completed. Topographic surveys are now in progress on the diversion dam and reservoir sites.

(c) Purgatoire River surveys.—Located about 7 miles southwest of Trinidad. Cross sections of the river channel were taken to indicate the storage capacity available. Vertical and horizontal control surveys have been completed and topographic surveys are now in progress at the reservoir site.

(d) Republican River surveys.—Located about 9 miles southwest of Wray. Topographic surveys have been completed on the reservoir site. A weir has been installed on the stream to obtain information for use in water-supply studies.

Western slope, Colorado: (a) La Plata project.—The exploration work at Hay Gulch Dam site no. 1 was near completion. The test pits indicate favorable geological conditions.

(b) Mancos Valley project.—At Jackson Gulch Dam site, a considerable amount of glacial deposit has been encountered in the test pits at higher elevation, and the lower pits indicate favorable geological conditions. The project map is near completion.

(c) Paonia project.—The crop census of the project was completed and is now being summarized. Topography sheets

were inked and checked. Water-right records were listed and tabulated.

(*d*) *Roan Creek project.*—Test-pit work was completed on Carr and Kimball Creeks. Water rights were listed and tabulated. The draft of field report was completed.

(*e*) *Silt project.*—Water-right records were checked and tabulated on Rifle and Elk Creeks. A crop census was made and summarized. Topography was supplemented on the West Elk Creek, and estimates were made on the proposed canals. The field work was completed.

(*f*) *West Divide Creek project.*—A crop census of the project was made and summarized. Estimates were made of yardages and small structures on the proposed canal from Buzzard Creek to the West Divide Creek. Water-right records were listed and tabulated. A preliminary reconnaissance report pertaining to Buzzard and Plateau Creeks was prepared.

Rio Grande Basin, Colo.-N. Mex.: (*a*) *Conejos River Reservoir and Dam sites.*—A study of water supply for the Platoro no. 6 reservoir was carried on during the month, in connection with which a determination was made of the irrigation uses in the river basin. Four test pits were completed during the month, disclosing a fairly tight silty material in the dam site and reservoir basin, but without reaching ground water. Diamond drilling at the site is contemplated.

(*b*) *San Juan-South Fork transmountain diversion.*—The study of water available for this diversion was completed.

(*c*) *Animas-Rio Grande transmountain diversion.*—The preliminary water supply studies were completed for the Weminuche Pass diversion being considered in connection with this feature, including a study of the effect of the diversion upon the water supply and operation of the Pine River Reservoir.

(*d*) *San Juan-Chama diversian.*—The preliminary water supply studies were completed and an operation schedule for the reservoirs and canals was prepared. Preliminary cost estimates were being made for siphons. Test pit work was begun late in the month at the Stinking Lake Dam site.

(*e*) *State Line Dam site.*—Triangulation surveys of the reservoir site and topography of the lower dam site were completed. Topography was being taken of the reservoir area when weather conditions made it necessary to discontinue the work at the end of the month. Diamond drilling was completed at the lower dam site and work was under way in adjacent areas to determine ground water conditions.

Boise (*Boise-Weiser-Payette*), *Idaho.*—Field work was seriously hampered by unusually cold weather and heavy snows which remained on the ground. Canal location topography was continued on the lines from Banks to Horseshoe Bend and from Boise diversion dam to Dry Creek and the completed field sheets were inked. Land classification of the Mountain Home area was continued. All of the field sheets were inked for the Weiser land classification and for the Cabarton Dam and Reservoir site.

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Madison River diversion, Montana-Idaho.—Areas of irrigable land were measured on the field sheets.

Gallatin Valley, Mont.—Field work was completed at the Spanish Creek Dam and Reservoir site at the mouth of Gallatin Canyon, and tables of area and capacity were prepared. Data were assembled and a review of the preliminary report begun preparatory to the preparation of a final report on the investigations.

Buffalo Rapids, Mont.—The supplemental report on these investigations was completed during the month and has been approved for distribution.

Saco Divide, Mont.—Draft of the final report on these investigations is in progress. Preliminary designs of the pumping plant are being made with particular reference to the relative economy of electrical and natural gas driven pumps.

Conchas project, New Mexico.—Location surveys were made of the canal location, including alternate lines. Strip topography was taken at critical sections and detail topographic surveys were made at three tunnel locations. Surveys of the canal and lateral system to define the upper boundaries of the irrigable land were carried on, and land classification was continued. Data were assembled in the Denver office for use in making studies of available water supply.

Deschutes, Oreg.—The manuscript of the draft of report on the Plainview project is complete and the maps and preliminary design and estimate therefor are in course of preparation. Field work was completed on the south unit project during the month and the consolidation of data into a final report is in progress.

Black Hills, S. Dak., (*a*) *Angostura project.*—A preliminary draft of the report on the project was completed except for the design and estimate of the dam, which is being prepared.

(*b*) *Rapid City project.*—At the end of the month nearly all of the relocated railroad line around the Pactola Reservoir site had been projected on the map.

Dixie project, Utah.—The draft of report on the Dixie investigations has been completed and is being typed for consideration by the Denver office. Canal alinement is being plotted and computations underlying cost estimates are being made for the Blue Bench investigations. Preliminary cost estimates and drawings for the Salt Lake Metropolitan Water District Aqueduct are nearing completion and the draft of report on this work will be finished shortly.

Colorado River Basin.—Weather conditions forced almost complete suspension of the work in Colorado, and only a small amount of classification in the Montezuma Valley was done.

Power Development on Reclamation Projects

The power output per month on the Federal reclamation projects now amounts to more than 100,000,000 kilowatt-hours, and the list of projects with output for January 1937, is as follows:

Project	*Output (Kilowatt hours*
Arizona, Salt River	7, 628, 380
Arizona-Colorado-Nevada, Boulder Canyon	82, 323, 000
Arizona-Colorado, Yuma	609, 083
Colorado, Grand Valley	261, 900
Idaho:	
Boise	2, 058, 717
Minidoka	2, 155, 000
Nebraska-Wyoming, North Platte	1, 536, 110
Nevada, Newlands	316, 090
Utah, Strawberry Valley	275, 023
Washington, Yakima	1, 953, 270
Wyoming:	
Riverton	185, 080
Shoshone	800, 100
Total	100, 101, 753

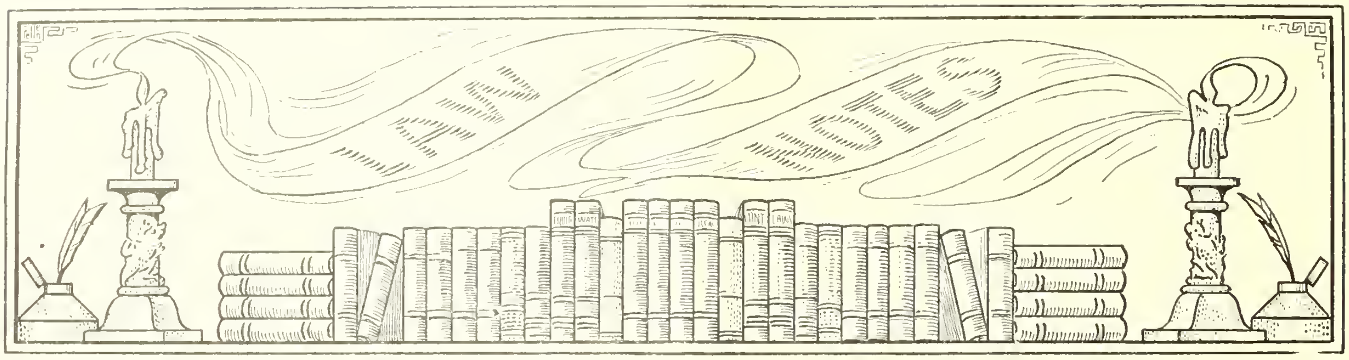
Gopher Catching

(Continued from p. 51)

Four years ago a similar contest which was conducted with the help of the school children, accounted for a total of more than 10,000 gophers. At that time prize money only was offered but no guaranteed bounty for each animal trapped. It is confidently expected that the present campaign will net even better results.

BROME grass continues to lead all grasses.—*Experiment substation, Beaverlodge, Alberta, Canada.*

INQUIRIES continue to be received by the Sun River project from qualified settlers for homesteads and farmers interested in moving onto irrigated tracts. The Resettlement Administration worked with a considerable force during most of December.



Supreme Court Renders Decision in "Fox v. Ickes et al."

THE Supreme Court of the United States on February 1, 1937, in an opinion (*Ickes* v. *Fox et al.*) by Justice Sutherland upheld the decision of the United States Court of Appeals for the District of Columbia, rendered June 8, 1936 (85 Fed. 2d, 294), refusing to order a dismissal of the suits brought against the Secretary of the Interior by plaintiffs Fox, Parks, and Ottmuller, water users on the Sunnyside division of the Yakima project, Washington, to enjoin the Secretary from refusing to deliver to them more than 3 acre-feet of water per acre per annum. The cases involved a dispute over the amount of water which the plaintiffs had obtained under their contracts with the United States. The attorneys for the United States moved in the trial court for the dismissal of the suits on the ground that the United States was a necessary party. The trial court refused to enter the order and its refusal was upheld by the United States Court of Appeals for the District of Columbia and later by the Supreme Court.

The court says:

"We are thus brought to the decisive question, Is the United States an indispensable party defendant? If so, the suits, however meritorious, must fail, since no rule is better settled than that the United States cannot be sued except when Congress has so provided; and here that has not been done. Petitioner's contention that the United States is an indispensable party defendant and, as it cannot be sued, the suits should have been dismissed, is based upon the propositions, as we understand them, that the United States is the owner of the water rights; that respondents' claims rest entirely upon executory contracts; and that the relief sought is the substantial equivalent of specific performance of these contracts.

"The fallacy of the contention is apparent, because the thus-far undenied allegations of the bill, as already appears, demonstrate that respondents have fully discharged all their contractual obligations; that their water rights have become vested; and that ownership is in them and not in the United States. The motion to dismiss concedes the truth of these allegations; but even if they were denied, we should still be obliged to indulge the presumption, in favor of the jurisdiction of the trial court, that respondents might be able to prove them (*United States* v. *Lee*, 106 U. S. 196, 218, 219; cf. *Tindal* v. *Wesley* (167 U. S. 204, 213 et seq.). In support of his contention, petitioner relies upon *American Falls Res. Dist. No. 2* v. *Crandall* (82 F. (2d) 973), but that decision, insofar as it is not in harmony with the view which we have just taken, must be disapproved.

"The suits do not seek specific performance of any contract. They are brought to enjoin the Secretary of the Interior from enforcing an order, the wrongful effect of which will be to deprive respondents of vested property rights not only acquired under congressional acts, State laws and Government contracts, but settled and determined by his predecessors in office. That such suits may be maintained without the presence of the United States has been established by many decisions of this court, of which the following are examples: *Noble* v. *Union River Logging R. R.* (147 U. S. 165, 171–2, 176), *Philadelphia Co.* v. *Stimson* (223 U. S. 605, 619), *Goltra* v. *Weeks* (271 U. S. 536, 544), *Work* v. *Louisiana* (269 U. S. 250, 254), *Payne* v. *Central Pac. Ry. Co.* (255 U. S. 228, 238). These decisions cite other cases to the same effect."

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- Arbor Day, its purpose and observance. Forest Service, Department of Agriculture, Farmers Bulletin No. 1492, revised Nov. 1936, 25 pages.

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- Seepage and uplift under dams. F. S. Besson, military engineer, Sept.–Oct. 1936, vol. 28, pp. 378–381.

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- Placing concrete by vibratory methods, paper presented at the annual highway engineering conference, University of Colorado, Jan. 14–15, 1937, with bibliography, 15 pages. Published in proceedings and in Rocky Mountain Contractor.

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- The future of the Great Plains, illus. Report of the Great Plains Committee of which Commissioner John C. Page is a member. Dec. 1936, 194 pages. Price 40 cents, Superintendent of Documents, Washington, D. C.

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- Arch dam of ice stops slide, illus. Engineering News-Record, Feb. 11, 1937, vol. 118, pp. 211–215. (Editorial p. 236.)

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- Greasing the skids at Grand Coulee, by H. W. Young, illus. Contractors and Engineers Monthly, Jan. 1937, vol. 34, no. 1, pp. 1, 18, 41, 49.
- Stopping the earth slide at Grand Coulee Dam, illus. Western Construction News, Jan. 1917, vol. 12, p. 15.

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- First report State planning board, period ending Dec. 1936, Will Simons, chairman, 136 pages.

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- Progress at Imperial Dam, illus. Eng. News-Record, Jan. 21, 1937, vol. 118, pp. 92–94.

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- Switchboards for Boulder Dam power plant, illus. L. N. McClellan, A. J. A. Peterson, and C. P. Garman, Electrical Engineering, Feb. 1937, vol. 56, no. 2, pp. 224–236 and 244.

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- The biggest thing on earth, map and chart, Grand Coulee Dam, Harpers, Feb. 1937, vol. 174, pp. 247–258.

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- Subsoil waters of Newlands (Nevada) field station. Tech. Bull. no. 533, Dept. Agr., 1936, 30 pages.

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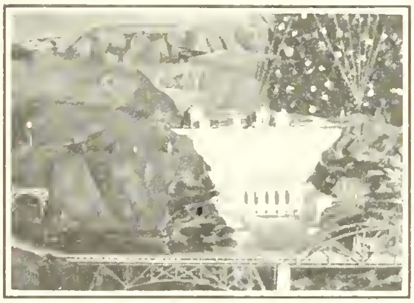
- Thirty-first annual report, State Rivers and Water Supply Commission, 1935–36, R. H. Horsfield, chairman, 51 pages and map.

Boulder Dam Model Feature of Christmas Party



This model is the work of Captain Gail of the Dundalk Police Department, Dundalk, Md. It was modeled from photographs and data supplied by the Bureau. It was the main attraction in a garden display shown for the period of a month before Christmas.

Captain Gail will feature another of our dams for next year's garden and has already applied for material to start work on a new model.

4–H Club Does Good Work on Pine River Project

The 4–H Corn Club of Ignacio, Colorado, did exceptionally good work during the past year. Five members planted Colorado 13 seed corn that produced excellent results. Richard Grabausky of Ignacio, planted yellow dent, and his corn took second place in the yellow dent class for 4–H corn club at the Colorado Pure Seed Show held in November 1936.

OWING to increased activity in the poultry industry on the Grand Valley project, the Utterback Poultry Co. has installed an all-electric, entirely automatic, incubator with a capacity of 52,000 eggs. It is intended to use eggs for hatching from accredited hatcheries thereby improving the strain of chickens through that territory.

Report of Great Plains Area Drought Committee

The report of the Great Plains Area Drought Committee entitled "The Future of the Great Plains" was forwarded to Congress by the President on February 10, 1937.

The report, which contains numerous illustrations, maps, and charts, consists of three parts with a supplement containing memoranda and appendixes. Part 1 discusses general physical characteristics; part 2, use and misuse of lands and waters; part 3, program of readjustment and development. The supplement contains memoranda on capital and credit, taxation, legal problems, and education for conservation. The appendixes deal with results of soil and water conservation, benefits derived by areas surrounding irrigation projects, summary of conservation plans in a number of States, and copies of the grazing and underground water laws in the West.

The Great Plains Area Drought Committee consists of H. H. Barrows, H. H. Bennett, L. C. Gray, F. C. Harrington, Col. R. C. Moore, John C. Page, H. S. Person, and Morris L. Cooke, chairman.

Copies of the report 8 by 10 inches in size of 194 pages may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C., price 40 cents.

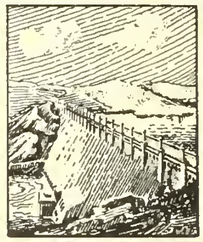
President Roosevelt Recipient of Yakima Turkey

President Roosevelt was presented by R. D. Mitchell, of Sunnyside, Yakima project, Wash., with the grand champion dressed turkey of the All-American Turkey Show held at Grand Forks, N. Dak., on January 18. Mr. Mitchell, who raised the bird, has made a clean sweep of all major shows during the past year. At the same show he won first and third in the heavy tom class. The Broadway Turkey Farm, another Yakima Valley entrant, took fourth in the heavy tom class and second and eighth in the young hen class.

The Grand Forks show is considered to be the oldest and most important exhibition of its kind held in the United States.

ACCORDING to the latest survey of the Federal Census Bureau, 51 manufacturing and producing plants in the city of Yakima turned out products valued at $5,788,036 in 1935. In 1933, 36 plants turned out products valued at $4,009,090.

ENGINEERING



The Art of Pressure Grouting

From a Report by V. L. Minear, Associate Engineer, Boise, Idaho

MOST of the fundamental ideas employed in the construction of Boulder Canyon project were not new; only in size and grandeur did they surpass all others. Nor was the idea of pressure grouting new, although with a 726-foot dam and its underlying breccias as an immense laboratory, it saw itself develop into something of an art during the years of construction in Black Canyon. It has been said the fundamental principles underlying large projects are relatively simple, but their smaller details approach extreme complexity. Pressure grouting, an integral detail in the successful erection of dams, assumes this nature.

That pressure grouting is more easily defined as an art than a science is more or less obvious in that no one can accurately predict the complicated reactions which occur when mixtures of cement and water in varying consistencies are pumped under pressure, into rock of unknown monolithity. Preliminary geological surveys of the dam site can tell whether or not a dam of the type and size proposed is feasible, but it is left for the diamond drillers and grouting experts to correct what known and suspected imperfections there are in the foundations and abutments by trial and error. The information gained from a study of diamond drill cores is only general, the presence of an open seam in a specimen not necessarily indicating that the hole will take an appreciable amount of grout, for the crevice so intersected may be of purely local character. Skill, experience, and judgment in interpreting the behavior of a hole under actual grouting conditions are far more valuable than any amount of core drilling. In the early days of construction many mistakes were made, many beliefs were found to be erroneous, and, accordingly, much of the original equipment was redesigned to meet the demands of a growing new technique.

Strictly speaking, grout is a thin mortar, liquid enough to be poured, composed of sand, cement, and water. Pressure grout may consist of any suitable substance held in suspension or solution by the water which acts as a medium of transportation. Among such substances are sand and cement, standard cement, rescreened cement, clay, chemicals, and asphalt. The use of a sanded mixture was tried and discarded owing to the difficulty of holding sand in suspension. When it settles out of the grout stream it clogs the delivery pipe and frequently the hole itself. Thus, such a mixture is not recommended, especially for high-pressure grouting. A neat grout of standard portland cement turned out to be the best all-purpose grout, especially in the presence of grout leaks. For injection into tight rock, an extra finely ground and resifted cement was used, 98 percent of which passed a 200-mesh screen. Rescreening costs are high and the advantage can be usually overcome with ordinary grout by employing slightly higher pressures. However, rescreened cement is necessary in contraction joint grouting.

ROCK GROUTING

For convenience, the grouting at Boulder Dam may be classified under three groups: Contraction joint grouting, low-pressure grouting, and high-pressure grouting. In contraction joint grouting, the concrete was cooled artificially, to the mean annual temperature of the vicinity, and the predetermined joints were filled with a rescreened portland cement grout. Low-pressure grouting may be defined as being supplemental to concreting operations or preparatory to high-pressure grouting. High-pressure grouting is synonymous with rock grouting, its purpose being to seal faults, fissures, etc., which might permit the seepage of water after storage is begun. It is with rock-grouting this article has to deal. Properly executed, rock grouting constitutes an excellent precautionary measure; done under incompetent supervision, it is likely to become a costly and futile operation.

Grouting is not necessarily the actual sealing of the rock but encompasses all operations leading to the repairing of natural defects. The drill crews, of course, were the first to operate. Drill crews were organized to function equally well with jackhammers, drifters, or diamond drills; the crew, under normal conditions, consisting of the necessary drillers, chucktenders, and nippers, to keep four machines in operation. With few exceptions, all diamond drillers were developed on the job from the better, more experienced percussion drillers. They learned rapidly and became highly proficient. Runs of 100 feet of hole drilled in a single 8-hour shift were not considered remarkable. Because of the problems involved, the dam served as a proving ground for manufacturers of construction machinery. The performance of drilling and grouting equipment was such as to confirm the wisdom of those responsible for their choice. Ingersoll-Rand jackhammers, water lynors, and wagon drills were used in drilling the majority of the shallow holes; that is, up to 50 feet. For the deeper holes, Mitchell, no. 10-E, light, air-driven diamond drills were used. They gave excellent results, although at the outset were of too light construction. They were satisfactorily reinforced in the contractor's shops.

The bit used with this machine, of the solid (noncore) type (see photo), marketed under the trade name of Boulder Bit, gave excellent results. Its weakest point was the central stone, located on the axis of the hole. Because it has no translatory action, this stone is the first to give way.

GROUT CREW

The grout crew, a group of specialists, developed the art of grouting to a high degree during their years at Boulder Dam. A crew consisted of a foreman, a pumpman, a truck driver, a mixerman, a tubman, three hook-up men, a scout, and two dumpmen. Their equipment consisted of a grout mixer, a mechanically operated sump, and two high-pressure mud pumps mounted on a flat rack truck. When roads to the grouting site were not available the whole apparatus was lifted there bodily by means of one of the construction high lines. Various

1 Grout rig on upstream cofferdam. This rig is forcing grout into "C" line holes in the Nevada abutment.

2 Detail of grout rig operating on crest of dam.

3 Detail of diamond drill bit designed especially for drilling grout holes in dam. Bit is known as the "Boulder Bit."

4 Grout pump installed in grouting gallery of the dam. Grout descends by gravity from mixer installed in crest of dam into agitator seen in foreground. Pressure pump seen in background.

5 Detail of grout rig operations on crest of dam. Grout is discharged through pipe to left.

6 Primary screening machinery used in screening cement for grout. Cover removed from near screen.

7 Rear view of primary grout cement screening machinery showing feeder at top distributing worm and lower side of screen. Covers have been removed.

types of concrete mixers were used which were all more or less unsatisfactory because of slowness and inefficiency. Finally a mixer designed especially for grout was introduced by Bureau Engineer J. B. Hays and constructed in the contractor's shops. This mixer is a great improvement on concrete mixers, under field conditions mixing as much as 375 sacks per hour.

Grout in the sump must be stirred constantly to prevent sedimentation. When this occurs, the pump, the suction of which is located in the lower portion of the liquid, picks up the thickened grout, effectively plugging a slow hole. Manual stirring was found to be undependable, therefore, a mechanically agitated sump was designed and built in the contractor's shops. It was necessary for the tubman to regulate the speed of the agitator from time to time, for the pump, which was on the same line, gave the agitator a variable air supply. The pumping plant of each grouting unit was built around two Gardner-Denver 10- by 4½- by 10-inch high-pressure pumps, erected parallel and connected to a common discharge line in such a way as to facilitate operating either or both pumps at the same time, delivering grout or water to the hole or wasting as desired.

As grout settles in the bottom of the sump, thickening the mixture, it also settles in the pump members, progressively obstructing the passages until it becomes necessary to chip out the hardened grout. At the outset this was done as often as once each shift, until it was learned that by simply circulating water at the capacity of the pump this difficulty could be entirely eliminated, and a pump could be run for weeks without being chipped. Difficulty due to the pump becoming fouled with ice was experienced, even in the extreme heat of the summer. If there was any appreciable amount of water in the air supply, water traps and electric heaters were applied to the air line when grouting at more than 500-pounds pressure.

Except for the higher pressures, grout was pumped through a 1½-inch rubber hose, made by the Pioneer Rubber Co., Pittsburg, Calif. This hose gave excellent service for pressures up to 750 pounds, but beyond that pressure-tested wrought-iron pipe was used as a safety measure. Pipe is cheaper than hose in first cost, but it is much slower to use, and pipe-fitters' wages will soon eat up the difference. Lubricated steel valves of the stop-cock type, made by the Crane Co., were used exclusively and gave good service.

COMMUNICATION SYSTEM

An important feature was the communication system. Telephone lines, having outlets at regular intervals, were strung to all galleries in the dam, and grout scouts were able to report grout leaks with a minimum of delay. The grout lines could be connected to the main telephone line, making it possible to immediately communicate with a higher authority when difficulty arose.

Principal supplies, exclusive of mechanical equipment, were required for sealing leaks. They were wooden wedges, made of well-seasoned pine of approximately ½ by 1 by 3 inches; oakum or cotton waste, used for grouting in nipples; lead wool, used for sealing leaks and calking in nipples; Flash set blend cement, composed of portland and lumnite cement, used extensively for grouting nipples and sealing leaks.

Sacked cement was used throughout, being hauled from shed to mixer on flat-rack trucks, except in the case of inaccessible locations, where it was delivered by high line. Frequently it was delivered by gravity line from mixer to pump. This is satisfactory if the correct precautions are taken—the pump must be equipped with a mechanically agitated sump; the gravity line must contain no sags or traps; free flow must be maintained in the line; telephonic and bell or light signals must connect the pump and mixer. Paper bags are easier to handle, open, and empty, and are cheaper than cloth sacks.

In making grout connections, improper installation can cause a great deal of trouble. Precautions to be observed are all oil from thread-cutting machines must be removed from the nipple, preferably by burning; walls of the hole must be cleaned of all drill sludge; grout must be freshly mixed, using clean water and a reasonable water-cement ratio (0.9 ± by volume); the pipe should be tapped lightly with a hammer to insure contact and guard against entrapped air preventing the space between rock and pipe being completely filled; the connection must not be disturbed until the grout has fully set.

In rock grouting there are serious objections to pumping through long pipe lines. Because most holes take grout slowly, the cement settles to the bottom of the pipe, and when there is any increase in the pressure, this thickened portion is picked up, effectively plugging the hole. When a hose forms part of the grout line, there is a tendency for the grout to form an incrustation on its walls. An increase in pressure will therefore expand the walls, causing the crust to flake off, again plugging the hole. When one section of the pipe is a riser, there is a tendency for the water to travel ahead, leaving thickened grout in the lower portion of the system. The water-cement ratio is thus inadvertently varied, and the hole is lost. Another serious objection is the inflexibility of a long line. Successful grouting is dependent upon varying the consistency of grout to the peculiarity of the hole. The idiosyncrasies of a hole vary greatly and rapidly, and in the case of a long line, these changes cannot be met with alacrity. Long lines can only be used in conjunction with prompt telephonic communication between pump and hole, otherwise intelligent grouting is impossible.

PRESSURE WASHING

Experience indicates that the amount of cement which can be injected into a hole depends upon the character of the rock penetrated, the pressure applied, the rate of pumping, and the water-cement ratio. The character of rock penetrated determines the amount of grout the hole will take; clearly a badly broken or fissured rock will take more than one undisturbed Most crevices are partially, if not completely, filled with gouge or other sedimentary material, which tends to absorb the moisture. Thus, if even a thin grout mixture is applied in the initial injection, the carrying water is absorbed and the remaining cement plugs the hole. Then, too, drill cuttings lodge in the smaller fissures penetrated, and although some of these are soluble, most of them effectively plug the hole. In addition, even in the absence of badly broken rock, dry rock tends to absorb the water from the grout, thickening the mixture and plugging the hole. To alleviate these difficulties, pressure washing was very effectively employed as the initial injection. Full grouting pressure was applied and maintained as long as there was any pick-up in the pumping speed; however, nothing was gained by pumping large quantities of water into loose holes.

Some engineers question the use of water, particularly in the case of tight rock, as the water fills pockets which would otherwise be occupied by cement. On the other hand, it may be maintained that under high pressure the water is forced into the rock pores; or if there is no escape of water, there is no need of grout in that particular crevice. All high-pressure holes at Boulder Dam were pressure washed with water or thin grout mixtures and the superiority of the former for local conditions was definitely established.

The maximum pressure at which grout injections should be made is also dependent upon the character of the rock. The pressure should not be great enough to disturb the natural formation by lifting the strata, but on the other hand, it can be seen greater penetration can be had by increasing pressures. Thus, the deeper

the hole, the greater the pressure. There is, unfortunately, no basis for the establishment of a safe maximum pressure, except arbitrary opinion based upon experience and judgment. Alternate drilling and injection certainly permits much higher pressures than one injection at the ultimate depth of the hole. Any seam large enough to cause the loss of drilling water should be grouted before proceeding with the drilling of that hole. The minimum pressure should be limited to that necessary to maintain a rapid and even flow of grout and prevent the plugging of holes. The hole should be filled in the shortest practicable time to prevent setting or formation of grout film.

The three variables—pressure, rate of pumping, and water-cement ratio—are proportional; that is, a variation in any will cause a variation in the others. Pressure is easily converted into a constant. Pumping speed was controlled by a manipulation of the water-cement ratio. Since there is a direct relationship between the water-cement ratio and the cement used, the change in the rate of consumption is an index to the condition of the hole.

The ability of water to carry suspended matter is dependent upon its velocity. Encrusting grout tends to reduce the internal diameter of the entire pipe to the size of smallest aperture through which it flows. It was found this could be eliminated by maintaining a reasonably high pumping speed and periodically injecting clear water. A close control of the pumping rate was necessary as a sudden increase in either speed or pressure resulted in the hole's refusal of grout. A dishonest pumpman can plug tight (unprofitable) holes by opening and closing the pump bypass valve in a manner such as to cause a water hammer effect.

The selection of a proper water-cement ratio is the most difficult phase of high-pressure grouting and undoubtedly more holes have been lost by inexperienced men attempting to use a thicker grout than the hole would accommodate than from any other cause. Adaptation of the water-cement ratio to the constantly changing conditions within the hole constitutes the secret of success in high-pressure grouting. The behavior of the pump, the rate of cement consumption, and the reaction of the hole to various changes in water-cement ratio are valuable aids in arriving at a correct solution of the problem. However, they are not infallible, and the solution must depend largely upon experienced judgment.

There is no universally accepted consistency of grout mixture that should initiate injection into a hole. On some work, grout of a milky consistency is first introduced; on others, a mixture of 1 part cement to 30 parts of water was used; another required that grout should not be thinner than 1 part of cement to 10 parts water, etc. Thin mixtures should only be pumped long enough to arrive at an estimate of the hole's resistance and enable the operator to proceed intelligently with the adjustment of the water-cement ratio. Since this consists of progressively reducing the water content to the minimum that the hole will tolerate, abnormally high water-cement ratio of the initial grout does not give much information and tends to prolong the period of adjustment. A rule-of-thumb method that worked very well at Boulder Dam was that initial injections should be of grout having a water-cement ratio equal to 0.01P where P was the limiting pumping pressure. Thus, a 500-pound hole would be started with a grout whose water-cement ratio, by volume, was 5.

So developed pressure grouting at Boulder Dam, where 385,309 cubic feet of grout were injected into 321,580 linear feet of hole at pressures ranging from 50 to 1,000 pounds per square inch. The men who directed this work were, or became, artists in their way, adding invaluable knowledge to the repertoire of dam builders of the future.

Workman Have a Care!

Many lives are lost in construction work largely through carelessness. Ofttimes a careless workman not only endangers his own life, but the lives of other workmen around him. Added to this, are the serious hardships imposed upon the dependents of the careless workman. This is the most vital aspect to be taken into consideration. If, through thoughtlessness and indifference to the hazards of construction work, a workman loses only his own life that alone brings commiseration, but the pity of it all is the resultant stark catastrophe imposed upon the breadwinner's family.

M. Pete Shrauger, safety engineer of the M. W. A. K. Co., at Coulee Dam, stresses these thoughts in the Columbian—a mimeographed monthly devoted to activities of employees of the construction company at Mason City, Wash.

Mr. Shrauger says: "If you suffer a disability there is 1 chance in 88 you will be killed, and 1 in 25 you'll be partially maimed the rest of your life."

Well worth pondering by engineers and workmen on all Reclamation projects.

Do the job right. There is no short cut to safety.

It pays to play safe, and it also pays your family.

A NUMBER of inquiries have been made and a number of prospective settlers called at the Vale project office, Oregon, during December. Lands have been selling fast on the Willow Creek unit. It is estimated there will be 150 water users on this unit in 1937, an increase from 58 during 1936.

A 40-ACRE farm on the Carlsbad project, New Mexico, was reported sold recently at a price of $125 per acre.

CONSIDERABLE interest is being shown in the proposed establishment of a State demonstration farm on the Yuma Mesa, Yuma project, Arizona-California, to determine the type of crops suitable for the Gila Valley project. The State legislature appropriated $18,000 for this purpose in November 1936.

YAKIMA County, Wash., now has a total of 6,763 farms, according to a recent report of the Census Bureau. The farm population of the county is 31,892, or practically the same as in 1930. Of the present farm population, 3,025 were city dwellers 5 years ago.

Nomenclature

The name "Gila project" has been adopted as official rather than "Gila Valley project."

The storage dam on the Pine River project in Colorado, on which construction work will soon be started, is to be known as the Vallecito Dam.

New Maps Issued

The Bureau of Reclamation has issued three maps which may be obtained upon application to the Bureau at the prices indicated, payment to be made in advance by check or money order drawn to the Bureau of Reclamation. The maps are as follows:

Map no. 26999 (1936), "Federal Reclamation Projects in Utah" (colored), size 10½ by 14 inches. Price 10 cents each.

Map no. 27450 (revised 1936), "Klamath Project Map" (colored), size 10½ by 13½ inches. Price 10 cents each.

Map no. 27450-A (revised 1936), "Klamath Project Map" (colored), size 22 by 27½ inches. Price 25 cents each.

Foundation Exploration with 36-Inch Drills

A MOST valuable recent contribution to exploration work is the large-diameter core drill which drills smooth-walled holes large enough in diameter to permit the engineer or geologist to enter the hole and examine the exposed section of rock in place. Drilling is accomplished by a rotating cylinder of the proper diameter employing shot as a cutting medium or, in soft rock, using steel or hard alloy cutting teeth. The core is broken loose from the bottom of the hole by small charges of explosive inserted at three or more points in the bottom of the circular cut, or by wedges driven between the core and the side wall of the hole. The latter method has proved more successful when the rock is softer and susceptible to shattering by the explosive. The core is lifted by an eyebolt wedge device inserted in a small-diameter hole drilled in the center of the core, or by means of a cable sling around the core when the material is too soft to permit the use of an eyebolt. In soft, friable, or broken material which does not permit extraction of cores intact, sections of the cores are broken and the materials removed by a large auger with scarifying teeth. The finely broken material is lifted on the auger itself.

INSPECTION HOLES

These large drill holes afford a means of inspection of rock in place which is superior to any method available. For instance, the side walls of shafts put down by the usual mining methods are generally shattered and disturbed by the explosive used and much of their area must necessarily be hidden by timbers. In drilled holes, a smoothly cut, in some cases, almost polished, continuous surface of undisturbed rock is available for examination. The spacing and tightness of joints, seams, and fissures can be observed, and the existence and nature of soft layers not ordinarily recoverable in small-diameter core drilling is disclosed in a manner not possible in the broken disturbed walls of test pits or shafts.

These inspection holes are useful only where the amount of water entering the hole can be controlled by pumping or by grouting. In permeable or open rock permitting water to flow too freely to be controlled by pumping, the anticipated inflow may be reduced by grouting the rock previous to drilling the hole. This may be done by a suitable number of grout holes drilled outside of the proposed large-diameter hole or by one or more grout holes drilled within the circumference of the proposed hole. The large-diameter hole in pregrouted rock affords valuable information as to the behavior of the grout. In light-colored rock it is advantageous to employ colored grout to aid in discriminating between rock and grout.

The Bureau of Reclamation has used 36-inch diameter core drills to good advantage in exploring the foundation conditions on three of its large projects—Columbia Basin project, Washington, Central Valley project, California, and Colorado River project, Texas. An Ingersoll-Rand type WS-2 calyx drill is being used for foundation explorations at the Grand Coulee Dam in Washington. This drill outfit is powered by electricity and has given satisfactory service in drilling through a foundation of hard granite. A complete report of the drilling operations is not now available as the work is still in progress. However, the accompanying tabulation of data from 8 holes involving 11 set-ups of the equipment shows the pertinent facts involved and is fairly representative of the entire job.

The drilling costs shown in table 1 include labor, equipment rentals, service charges, materials, and maintenance of drill and drill barrels, but do not include any allowance for depreciation of equipment. The maximum depth of hole to date on this project is approximately 68 feet.

Large-diameter holes have been drilled at both the Friant and Kennett Dam sites on the Central Valley project in connection with the foundation explorations there. At Friant Dam site, an Ingersoll-Rand type WS-3 gasoline-engine-driven drill was used to drill eight holes, ranging in depth from 38 to 60 feet, for a total of 392.5 feet. The rock at this dam site is a biotite schist, varying from soft to moderately hard, traversed by numerous joints. The advantages of an adequate supply of compressed air for efficient drilling operations were clearly emphasized on this job, as part of the holes were drilled with an air supply available and part were drilled without compressed air. An air-operated sump pump was shown to be most useful for unwatering the hole prior to removing the core; this type of pump is especially desirable when considerable inflow of ground water was encountered. An air supply is also very desirable for clearing the blasting fumes and gases from the drill hole after the core has been broken loose. When the air was not available, considerable time was lost in waiting for these gases to be dissipated normally. Then, too, compressed air facilitates the drilling of the holes in the cores for setting of the lifting bolts. All of these factors are of importance in formulating a well-organized drilling program.

A special cutting shoe of hardened steel was designed and adapted to the standard core barrel which greatly increased the efficiency of the drill. This shoe had the advantages of reducing the wear on the cutting edge because of its hardness, reducing the friction on the core barrel, increasing the rate of drilling because of better manipulation of the shot under the hardened cutting edge, simplifying and lessening the cost of the replacement of cutting units by substituting the replacement of a shoe for the replacement of the entire core barrel.

Table 2 is a tabulation of the cost of drilling the eight holes at the Friant Dam site. These are direct costs only and do not include cost of supervision, equipment rentals, depreciation, or other indirect items of expense.

The rock at Kennett Dam site is classified as schistose meta-andesite and agglomeratic meta-andesite and is moderately hard with numerous broken seams. No unusual difficulty has been experienced in recovering a high percentage of core intact. The drilling program at this dam site has not been completed, but data concerning the progress to date, three drill holes, are shown in table 3.

Two 36-inch Ingersoll-Rand calyx drills have been used on the Colorado River project, Texas. One was used for exploring the quarry at Hamilton Dam and the foundations at Arnold Dam, and the other is now being used to explore the foundations at Marshall Ford Dam site.

Two holes were drilled in the quarry at Hamilton Dam, one to a depth of 45 feet and the other to a depth of 56 feet. The rock drilled is a medium hard dolomite with very few horizontal seams. In several cases it was possible to take out cores practically as long as the barrel. Figure 1 shows a 5-foot section of 36-inch diameter core weighing approximately 3 tons cut with a 5-foot 6-inch barrel. With this rock the usually prescribed method of breaking the cores from the base by exploding dynamite in the crack formed by the cutting edge was tried with little success. The cores were badly shattered and in many cases they had to be removed piece by piece. To avoid this difficulty, a method of wedging the core off was adopted. This method consisted of driving at least three wedges behind shoes placed on one side of the core and thus either moving the core on a horizontal seam or breaking it off near the base.

Table 1

Total working time to date hours	2, 866. 75
man-hours	7, 215. 48
Total drilling time to date hours	1, 167. 76
man-hours	2, 454. 49
Percentage of working time used in drilling...percent	40. 7
Total delays—equipment failures and service hours	201. 82
man-hours	436. 57
Total time for moving drill and removing cores and rods...hours	1, 497. 17
man-hours	4, 324. 42
Total shot used...pounds	9, 130. 0
Total depth drilled...feet	385. 69
Shot used per foot of drilling pounds	23. 7
Drilling per hour in feet of working time	0. 13
drilling time	0. 33
Total cost of drilling	$12, 105. 87
Cost of drilling per foot	$31. 39

Table 2

Moving and setting up drill	$1, 066. 86
Drilling	2, 145. 99
Removing core	2, 282. 81
Repairs to equipment	528. 87
Alterations of equipment	201. 90
Truck charge and general expense	1, 002. 45
Total cost of drilling	7, 228. 88
Cost of drilling per foot of hole	$18. 42
Total pounds of shot used	3, 202
Pounds of shot per linear foot of drilling	8. 1

Table 3

Total working time to date [1] [2]	4, 694
Total drilling time to date [2]	1, 834
Percentage of working time used in drilling...percent	39. 1
Total delays—equipment failures and service [2]	294
Total time for removing core [2]	2, 566
Total time for moving drill [2]	1, 256
Total shot used...pounds	4, 650
Total depth drilled...feet	187. 5
Shot used per foot of drilling...pounds	24. 8
Drilling per man-hour of working time...feet	0. 04
Drilling per man-hour of drilling time...feet	0. 10
Total cost of drilling	$4, 994. 06
Cost of drilling per foot	26. 63
Net cost of drilling [1]	4, 224. 80
Net cost of drilling per foot [1]	22. 53

[1] Does not include time or cost of moving drill rig.
[2] Man-hours.

(Continued on p. 64)

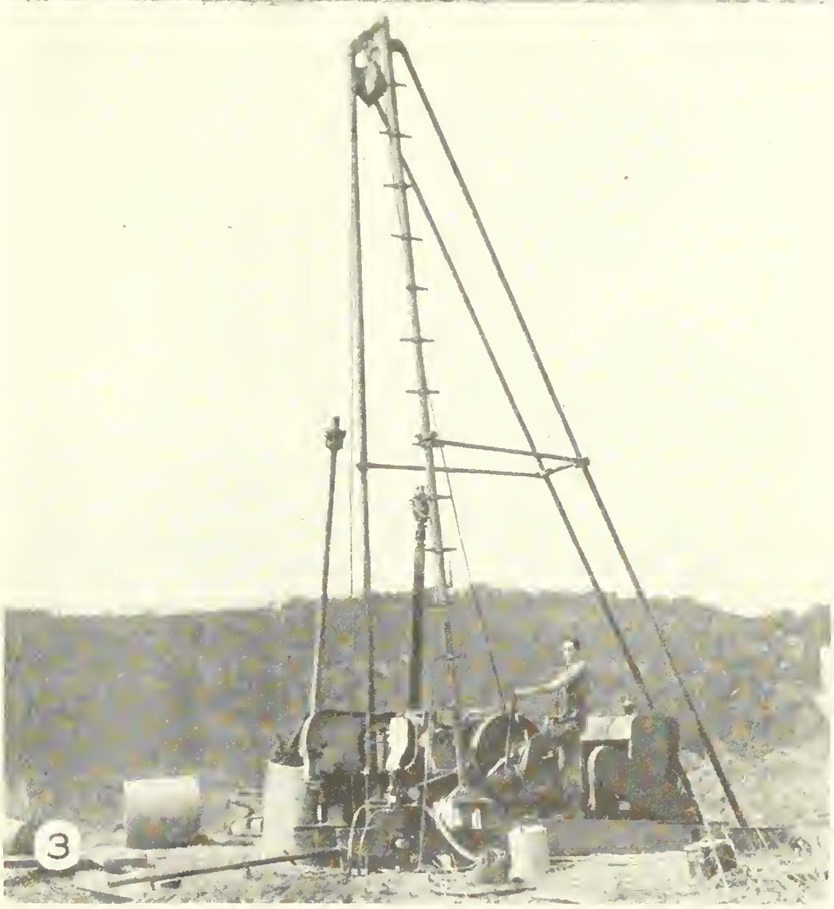
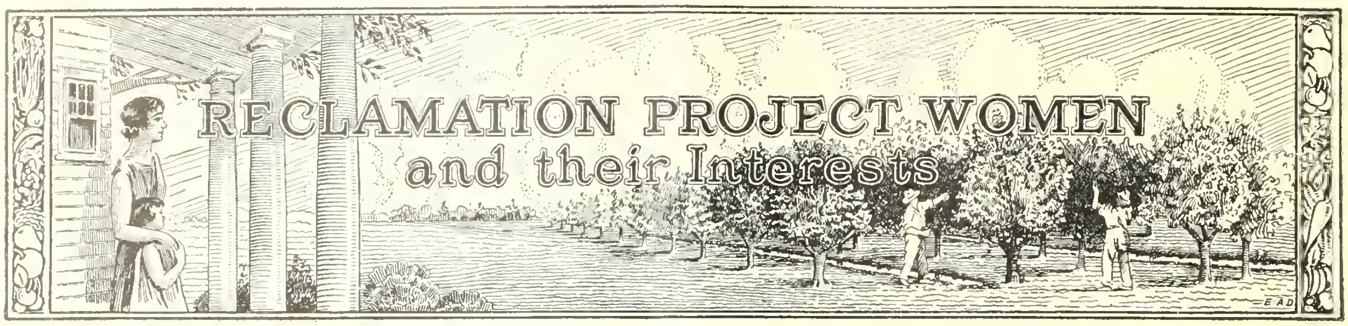


FIGURE 1.—36-INCH CALYX DRILL WITH CORE FROM QUARRY AT HAMILTON DAM. ROCK IS DOLOMITIC LIMESTONE WHICH IS CRUSHED TO MAKE COARSE AGGREGATE FOR CONCRETE IN THE DAM.
FIGURE 2.—36-INCH CORE FROM 92-FOOT HOLE, MARSHALL FORD DAM SITE, COLORADO RIVER PROJECT, TEXAS, NEAR AUSTIN.
FIGURE 3.—INGERSOLL-RAND 36-INCH DRILL CALYX W-3 IN USE AT MARSHALL FORD DAM SITE. NOTE FIRST PIECE OF CORE TO THE LEFT OF THE MACHINE.



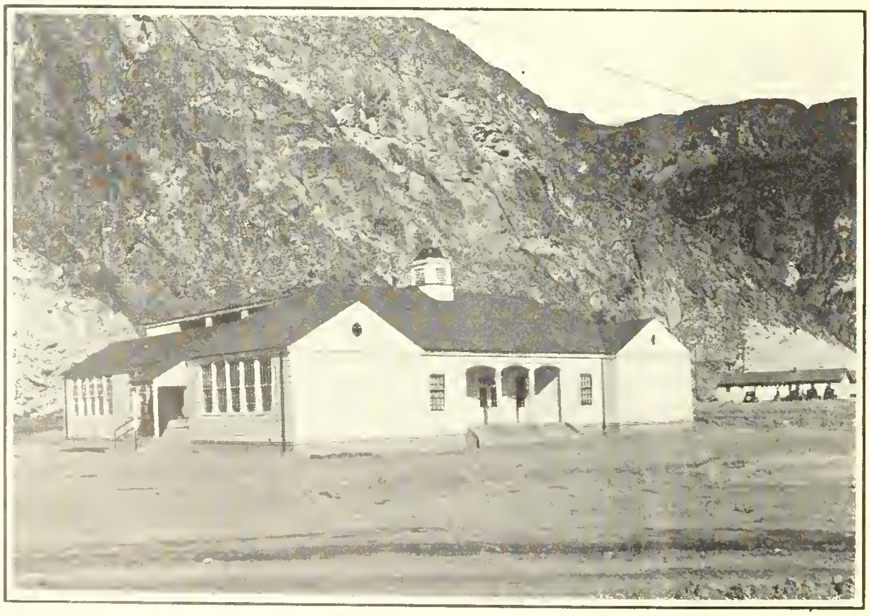
"Where Rolls the Mighty Oregon"

By Leona Clevenger, Coulee Dam, Wash.

COULD Bryant have perceived the full significance of his "Mighty Oregon" when he wrote Thanatopsis? This same Columbia River possesses one-fifth of the potential water power of America. It is indeed mighty. From its source in Lake Columbia the river is fed by melting snow fields, lakes, and glaciers, flowing generally southward to a point in eastern central Washington; then, as if it suddenly changed its mind it flows north and west. From this point extending 50 miles to the south is the Grand Coulee Canyon. Geologists tell us at the close of the glacier period when the ice dams receded, the Columbia resumed its course, leaving this coulee a hanging valley. Its floor is more than 600 feet above the river. The nearly perpendicular walls are 600 to 1,000 feet in height. In its bed, lakes nestle at intervals. Its grandeur and beauty I would leave for the poet, the artist, or the camera to depict.

Nature appears to have designed the Grand Coulee Dam site for the purpose it is now being used. Men with vision sought to build here a great dam harnessing this mighty Oregon to bring life-giving water to 1,200,000 new acres, known as the Columbia Basin, and to create cheap electrical power for homes, American homes, with assurance from drought and the blessings of electrical energy. As surely as our pilgrim fathers braved the deep to found a nation, and our pioneer fathers blazed the trail to claim a nation, our reclamation fathers are building to conserve a nation!

Three years ago the Grand Coulee Dam site was a part of a virgin wilderness of sage and sand with one lonely farm house. Today it has an approximate population of 15,000 people. There are two official towns. Mason City is on the east bank of the river. Here are the homes, offices, and trade centers for the families of the four major companies contracting with the Government to build the dam. These homes are built for uniformity and convenience. Directly across the river, on the west bank, are the homes and offices of the employees of the Bureau of Reclamation. They are designed for beauty in landscaping and architecture, as they are for permanence. The Government contracts made provision for schools for these communities. They have joined as one district with three schools. With the opening of the school year in September 1935 the teachers found an assemblage of young Americans from all corners of the United States, with surprising difference in manners and accent. The first lesson to be learned was in personal adjustment for both teacher and pupil, to become acquainted with each other, and accustomed to outside furor, blasting of earth and rock, roaring of trucks, pecking of jackhammers, pounding of pile drivers, the frequent wail of sirens, and the hum of a plane, and all to become as undisturbing as the tick of a clock.


FRONT AND SOUTH VIEWS OF GOVERNMENT'S SCHOOL AT COULEE DAM

MASON CITY AND COULEE DAM—ONE COMMUNITY

A community, to deserve that name, must learn to live together for common cause. The Parent-Teacher Association was the major factor in welding these two towns into a community. When the all-embracing arms of this association were extended in an invitation for organizations, parents and teachers welcomed it. They came—they organized the Coulee Dam Parent-Teacher Association. It is graced by Eastern dignity, Southern generosity and hospitality, Middle Western earnestness and sincerity, and is spurred by Western energy.

That the school be promptly provided with those equipments not provided by school funds, but due modern American schools, was the association's first concern. These were cared for as they were presented from a $90 fund, which was obtained by a Saturday morning food sale. The fine response in form of donations proved the communities' interest in the work. Programs were planned to fit the needs; they favored discussion groups with teachers and parents stress-

ing topics of common interest. The groups provided with leaders are: High school, intermediate, primary, and preschool, the preschool being divided to provide a study group for mothers of infants. This fascinating group of young matrons has outlined a course of study that reads like a would-be college course in parent education. This seems to be their life's chief concern. They will look well to future America.

The majority of the population of the Grand Coulee Dam area live in other small centers in close proximity to the dam—Grand Coulee, Osborn, Delano, Electric City, and Elmerton by name. These necessary towns present quite a different picture. The sides of the hills are literally covered with one- and two-room unpainted homes that have popped up at random. The main thoroughfares would provide a typical setting for a frontier picture. Its dust in the summer and mud in winter is cleverly described by a young editor of Grand Coulee:

"Delicate feet that once felt the
Sweet caressing softness of dust
In the street
Encased in galoshes are slopping
In marshes of mud,
Grand Coulee mud."

Here reside the true pioneers of the project, the butcher, the baker, the candlestick maker, as well as the construction workers, happy and courageous in their work, for they are builders, and a part of a very new community. For the most part these towns remind us of an adolescent boy who in 2 years' time has outgrown his coat and pants and now makes just demands for more dignified and becoming attire. City officials, city ordnances for law and order, as well as improvements of streets are in demand. Out of the little brown homes on the sides of the hills come these demands, and the first was for schools. The superintendent of the Grand Coulee schools states: "The growth of the school system here is an amazing story of pioneer courage and cooperation." The answer from the State authorities was: "Build your school and a teacher will be provided." Within 3 days' time through subscriptions and donated labor the school was built. Barely 3 years ago the school was opened with 17 pupils; now there are 1,059 enrolled and 4 school buildings.

The first parent-teacher association to be organized in the area was the Grand Coulee Parent-Teacher Association. To these parents and teachers were presented the most unique if not the most difficult problems ever presented in this State. Lack of room necessitated plans of double shifts for classes; problems of health and safety were of great concern. Through the cooperation of the home, school, and community an almost normal condition has been attained.

Seven parent-teacher associations have been organized around the dam, each holding forth pride in the part it has

(Continued on p. 64)

THE COLUMBIA RIVER BEING SLOWLY FORCED FROM ITS ANCIENT COURSE AS CONSTRUCTION OF GRAND COULEE DAM PROCEEDS. A COFFERDAM IS BEING CONSTRUCTED ACROSS THE RIVER

Minidoka Farm Women Busy and Happy

By Mrs. Hazel G. Woodall, Burley, Idaho

GARDENING, canning, and needlework held the attention last summer of most farm wives on the Minidoka project. Samples of many of these products were on exhibit in the fall at the Cassia County fair, showing the high type of cooking and sewing that is being carried on in our midst by the wives of the tillers of the soil.

Many attractive exhibits depicted the skill that housewives today exercise in the preparation of their foods for the winter months. Storage greenstuffs were of the highest quality, as they, too, were displayed to the view of the fair visitors.

Canned fruits, vegetables, and meats, home-baked goods prepared in modern kitchens, wherein have been installed electrically operated equipment, were indeed a delight to the eye of the most exacting connoisseur.

Owing to the fact that electricity generated by the Government power plant at the Minidoka Dam furnishes farmers here with cheap electric power, most of the ranch homes are as well equipped electrically as are those of the most fastidious housewives residing in our larger cities. This has enabled these women to go the limit in the preparation of foodstuffs, that are worthy of exhibit, not alone in the Cassia County fair, but elsewhere.

The needlework and other handicraft that occupies a portion of their leisure time was of the very highest type, some very intricate patterns having been carried out in quilts, fancy work, hooked and knitted rugs, embroidery, and crocheting.

Leading up to this work of the farm women are the madeovers, the sewed garments, fancy articles, and other handiwork, which 4-H club girls are taught by the extension division of the University of Idaho in conjunction with the State department of agriculture. This is a big stepping stone for the young housewives and mothers of the future.

Should one question the proficiency of the modern farm woman, when she, too, has the facilities at hand, combined with her own products of the soil right at her very elbow and her own skill to prepare food and clothing for her family needs in the most up-to-date way?

Teaching of vocational home economics in Burley High School, 4-H club work, and through Better Homes and Gardens clubs' demonstrations, under extension workers, has provided training for these girls and women, that is unexcelled anywhere else in the world.

Need one go farther than sunny southern Idaho and more particularly the Minidoka project to find better climate, more fertile soil, pleasanter surroundings, and opportunity for more educational advantages than right here in Burley? We ask.

Foundation Exploration

(Continued from p. 61)

At Hamilton Dam the rock was hard and, with air available, a hole was drilled in the top of each core and a split eyebolt with a ring attached was wedged into the hole. The hoisting cable was attached to the ring and the cores lifted out without difficulty.

The foundation for Marshall Ford Dam is being explored with the calyx drill formerly used at Friant Dam site. The rock at Marshall Ford is quite different from that encountered at Hamilton Dam, being a badly weathered limestone, alternating with layers of clay and shale. The soft nature of a large portion of this rock made the use of the eyebolt and wedge method of lifting the cores both expensive and dangerous. Cores would separate on bedding planes, or the rods would pull out when the core was raised. To avoid this difficulty a sling was made by using one of the six strands from an old ¾-inch cable. To apply the sling takes only a few seconds, and its grip on the core is certain. The sling is made by bending a loop of the cable at right angles, the loop forming one-half of the collar and the handle. The other half of the collar is formed by a section of cable with sliding loops on the vertical portions forming the handle. With this arrangement, when the lifting force is greater, the grip of the horizontal collars becomes correspondingly stronger. By this method, cores with numerous bedding planes or clay seams can be lifted intact.

At Marshall Ford site under the proposed embankment section, a porous stratum was known to exist at approximately elevation 565. In the diamond core drilling a large portion of the core was lost in this section, and no pressure could be developed even after hours of pumping water into the holes. To explore this stratum two 36-inch holes have been drilled, one to a depth of 67 feet and the other to a depth of 92 feet. No particular difficulty was encountered in drilling these holes. Wedges were used to break the cores loose, and slings as described above were used to lift them out. Figure 2 shows the cores after being taken from the 92-foot hole. A 3-foot barrel was used on this hole, and the majority of the cores are a full 3 feet in length. Several of the cores separated at clay seams and bedding planes on being rolled to the positions shown.

After reaching a depth of about 60 feet, the drive rod was found to whip to such an extent that a considerable portion of the power was lost. This whipping was eliminated and the rod kept centered by means of wooden struts tightened in the hole by wedges.

To date the actual cost of drilling, not considering depreciation of equimpent and moving and setting up the machine, has averaged about $5 per linear foot of hole. The cost of moving and setting up the machine varies with conditions at the particular location and the number of linear feet drilled at each set-up. On some shallow holes this cost is greater than the actual cost of the drilling.

The Mighty Oregon

(Continued from p. 63)

played in community building. The prevailing pioneer spirit has laid the corner stone for future associations to come with 2,000,000 home makers who will inhabit the now arid area. May the rainbow reflected from the first mist of the mighty falls signify health, happiness, and prosperity for new homes, schools, and communities.—*The Washington Parent-Teacher.*

"The Sugar Beet"

The Reclamation Era is glad to receive on an exchange basis the quarterly magazine "The Sugar Beet", vol. 1, no. 1 of which is in print. With this issue publication of the magazine is resumed by the Amalgamated Sugar Co. after a lapse of 5 years. This company serves Federal reclamation projects in the States of Utah, Idaho, and Oregon, and inspections are being made in the territory covered by the Owyhee project, Oregon-Idaho, one of the newer projects of the Bureau.

Circulars Available

General information circulars regarding the Boulder Canyon, All-American Canal, Casper-Alcova, Columbia Basin, Gila, Central Valley, and Yakima-Roza projects and projects in Utah are now available and may be obtained by addressing the Commissioner, Bureau of Reclamation, Washington, D. C.

Notes for Contractors

Specification no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
712	1937 Jan. 12	Colorado River, Tex.	Office building, dormitory, and residences.	J. R. Blackmore	Austin, Tex	$43,356.00		1937 Jan. 29
716	Jan. 11	Shoshone-Heart Mountain, Wyo.	Earthwork and structures, Heart Mountain Canal.	Morrison-Knudsen Co	Boise, Idaho	182,702.00		Jan. 28
858-D	1936 Dec. 28	Boulder Canyon, Ariz.-Nev.	Turbine flow meters for units N-5 and N-6, Boulder power plant.	Simplex Valve & Meter Co.	Philadelphia, Pa	1,410.00	F. o. b. Boulder City, discount 1 percent.	Feb. 2
859-D	Dec. 30	Minidoka, Idaho	Transformers, oil circuit breakers, disconnecting switches.	American Transformer Co.	Newark, N. J	12,765.00	Item 1, f. o. b. Minidoka	Do.
				Kelman Electric & Manufacturing Co.	Los Angeles, Calif.	6,763.82	Item 2, f. o. b. Minidoka	Do.
				The High Tension Co	Phillipsburg, N. J.	645.30	Item 3, f. o. b. Minidoka, discount 1 percent.	Do.
860-D	1937 Jan. 5	Colorado River, Tex.	Concrete laboratory and combined garage and fire station.	Rex D. Kitchens	Austin, Tex	14,670.00		Jan. 29
861-D	Jan. 6	do	4 duplex cottages.	J. R. Blackmore	do	13,017.00		Feb. 6
863-D	Jan. 14	Boise-Payette, Idaho.	Structural steel for railroad bridge at station 5+32.61, Black Canyon Canal.	Bethlehem Steel Co	Bethlehem, Pa	1,750.00	F. o. b. Chicago	Jan. 20
864-D	Jan. 18	Salt River, Ariz	3-6 foot by 7-foot 6-inch high-pressure gate assemblies for Bartlett Dam.	Consolidated Steel Corporation, Ltd.	Los Angeles, Calif.	50,447.00	F. o. b. Los Angeles	Feb. 6
865-D	Jan. 15	do	2 72-inch-diameter outlet pipes for Bartlett Dam.	Chicago Bridge & Iron Co.	Chicago, Ill	7,350.00	F. o. b. Birmingham	Jan. 23
866-D	Jan. 15	Casper-Alcova, Wyo.	Portable oil-purifier and filter-paper drying oven.	Goulds Pumps, Inc	Seneca Falls, N. Y.	2,300.00 125.00	Item 1, f. o. b. Seneca Falls, N. Y. Item 2, f. o. b. Pittsfield, Mass.	Do. Do.
868-D	Jan. 22	Salt River, Ariz	Bulkhead gate, gate guides, trash racks, etc.	Pacific Iron & Steel Co	Los Angeles, Calif.	560.00	Item 1	Feb. 3
				A. J. O'Leary & Son Co	Chicago, Ill	3,475.00	Items 2 and 5, discount ½ percent.	Do
				Berkeley Steel Construction Co.	Berkeley, Calif	4,950.00	Item 3, discount ½ percent	Feb. 4
				Southwest Welding & Manufacturing Co.	Alhambra, Calif	780.00	Item 4, discount ½ percent	Do.
42632-A	1936 Nov. 30	do	Steel reinforcement bars, 1,115,025 pounds	Sheffield Steel Corporation.	Kansas City, Mo.	28,991.84	½ percent discount b. p. v.	No award
44116-A	Nov. 24	Parker Dam, Ariz.-Calif.	Steel reinforcement bars, 684,007 pounds.	Columbia Steel Co	Denver, Colo	17,114.09	do	Do.
714	1937 Jan. 18	Salt River, Ariz. Carlsbad, N. Mex.	12 54-inch and 2 66-inch needle valves.	Joshua Hendy Iron Works	San Francisco, Calif.	45,596.00	F. o. b. Sunnyvale	Do.
42,177-A	Jan. 22	All-American Canal, Calif.-Ariz.	Clay sewer pipe	Gladding, McBean & Co	Los Angeles, Calif.	76,783.96	Items 1-4 f. o. b. Los Angeles.	Feb. 20
717	Jan. 28	do	Construction of highway bridges.	Lewis Chambers Construction Co.	New Orleans, La	74,258.00		Do.
2272-C	Jan. 7	Carlsbad, N. Mex.	12,000 bbls. of Portland cement.	United States Portland Cement Co.		37,298.14		Feb. 8
715	Jan. 18	Salt River, Ariz	Spillway for Mormon Flat Dam.	Gunther & Shirley Co. and J. P. Shirley.	Los Angeles, Calif.	396,014.50		Feb. 18
710	Feb. 1	Colorado River, Tex.	24-102-inch Paradox gates and conduit linings for Marshall Ford Dam.	S. Morgan Smith Co	York, Pa	583,000.00	8 gates f. o. b. York	Do.
				Koppers Co. (Bartlett Hayward Div.).	Baltimore, Md	588,800.00	8 gates f. o. b. Baltimore	Do.
				Hardie-Tynes Mfg. Co	Birmingham, Ala.	541,400.00	8 gates f. o. b. Birmingham	Do.
718	Jan. 28	All-American Canal, Calif.	Structural steel and castings.	Milwaukee Bridge Co	Milwaukee, Wis	41,407.00	F. o. b. Milwaukee	Feb. 11
867-D	Jan. 21	Boulder Canyon, Ariz.-Nev.	1,667-Kv. a., 60 cycle, 16,500/34, 500-volt auto transformers, air break switch, metering equipment.	Westinghouse Electric & Mfg. Co.	Denver, Colo	28,606.00	Items 1 and 4 f. o. b. Boulder City.	Feb. 15
				Johnson Electric Co	Atlanta, Ga	271.98	Item 3 f. o. b. Boulder City	Do.
869-D	Jan. 27	All-American Canal, Calif.-Ariz.	One 7-panel main control board and equipment; 3 master control cubicles; one 2,300-volt switchboard.	Ne Page McKenny Co	Seattle, Wash	16,278.00	Sch. 1 and 2 f. o. b. Yuma	Do.
871-D	Jan. 20	Salt River, Ariz	200,000 bbls. of modified Portland cement or low-heat Portland cement in bulk.	Riverside Cement Co	Los Angeles, Calif.	298,000.00 (combination bid)	F. o. b. Crestmore or Oro Grande.	Feb. 13
				California Portland Cement Co.	do		F. o. b. Colton	
				Southwestern Portland Cement Co.	do		F. o. b. Victorville	Do.
				Monolith Portland Cement Co.	do		F. o. b. Monolith	
38341-B-1	Jan. 28	Columbia Basin, Wash.	100,000 pounds of copper strips.	The American Brass Co	Kenosha, Wis	17,000.00	F. o. b. Odair, Wash	Do.
870-D	Jan. 29	Upper Snake River, Idaho.	Four radial gates and gate hoists.	Berkeley Steel Construction Co.	Berkeley, Calif	1,932.00	Item 1 f. o. b. Berkeley	Feb. 12
				Valley Iron Works	Yakima, Wash	1,600.00	Item 2 f. o. b. Yakima	Do.
873-D	Feb. 3	All-American Canal, Calif.-Ariz.	Reinforced concrete pipe.	Concrete Conduit Co	Colton, Calif	8,753.92	F. o. b. Calexico, Calif	Feb. 11
876-D	Feb. 10	Boise-Arrowrock, Idaho.	Structural steel and misc. parts for drum gate alterations.	California Steel Products Co.	San Francisco, Calif.	748.00	Item 1 f. o. b. San Francisco.	Feb. 17
				Pekrol Iron Works	Denver, Colo	1,633.25	Item 2 f. o. b. Denver	Feb. 16
872-D	Feb. 4	Riverton, Wyo	Cleaning Bull Lake reservoir site.	Nevada Construction Co	Nevada, Mo	16,400.00		Feb. 24

C. C. C. Builds Midview Reservoir and Canals, Moon Lake Project, Utah

By L. R. Dunkley, Associate Engineer

THE Duchesne Feeder Canal, Midview Reservoir, and Midview lateral are being constructed as a part of the Moon Lake project in eastern Utah by C. C. C. enrollees from Camp BR 11, near Bridgeland. The work program on these features, constituting a water-conservation project of a high order, has been underway since the inception of the camp on October 20, 1934.

GENERAL DESCRIPTION

The practically completed feeder canal is 17 miles long, has a capacity of 200 second-feet, and will divert water from the Duchesne River to the reservoir and to Indian project lands on the Lake Fork River in exchange for Lake Fork waters which will be utilized on the higher lands of the Moon Lake project. The Midview Reservoir, which will have a capacity of 5,000 acre-feet, will equalize the flow between the two rivers in addition to being used for direct storage. The Midview lateral will connect the reservoir with Lake Fork River and will be 9 miles long with a capacity of 80 second-feet.

The reservoir involves four principal features—an earthfill dam (known as the Midview Dam), outlet works, dike, and spillway. The Midview Dam, at the eastern end of the reservoir, will have a maximum height of 68 feet above bedrock, or 50 feet above normal stream bed, a crest length of 670 feet, and a top width of 30 feet between the concrete parapet wall and curb. The main body of the dam will consist of a moistened and rolled embankment of clay, sand, and gravel with a slope of 3:1 on the upstream side and 1½:1 on the downstream side. The upsteam slope will be protected with a blanket of sand, gravel, and boulders finished to a 3½:1 slope with a minimum thickness of 3 feet at the top and 10 feet at the bottom. On the downstream side, a section of sand, gravel, and boulders will be added, finished to a slope of 2:1 with a minimum thickness of 3 feet at the crest of the dam and 15 feet at normal stream bed. This downstream porous section continues to bedrock, filling the toe trench and enclosing a tile drain paralleling the toe of the dam for its full length. A cut-off trench 18 feet deep, 15 feet wide in the bottom, and with side slopes of 1:1 was excavated to bedrock under the upstream section of the dam. A concrete cut-off wall with a thickness of 2 feet and a height of 10 feet was constructed in the center of this trench with 5 feet of the wall in bedrock.

The outlet works of the Midview Dam consist of a 36-inch diameter outlet conduit 300 feet long, a gate chamber and tower, trash rack, and outlet basin and transition 40 feet long, all of reinforced concrete construction. The conduit was entrenched in bedrock through the left abutment of the dam with three 10- by 10-foot concrete cut-off collars between the trash rack structure and upstream cut-off wall. The control works consist of two 2.4- by 3-foot cast-iron slide gates, one regulating and one emergency, controlled by geared hoists to be located at the top of the dam.

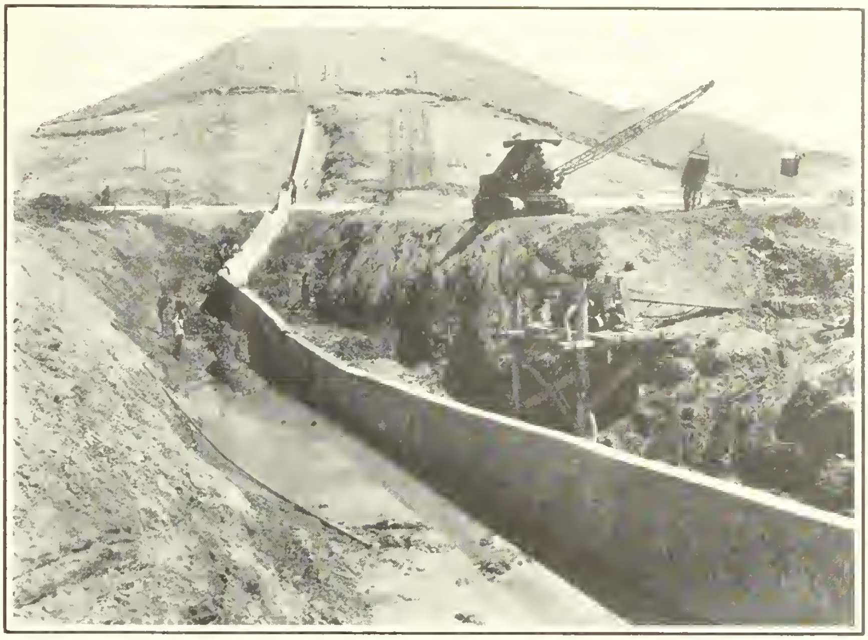
At the west end of the Midview Reservoir a dike has been constructed by C. C. C. enrollees consisting of a moistened and rolled embankment of clay, sand, and some gravel 2,500 feet long, having a maximum height of 21 feet and with 27-foot width on top finished as a gravel roadway. The downstream slope of the dike is 2:1 and the upstream slope 3:1, the latter slope being protected with a blanket of gravel and boulders with a minimum thickness of 3 feet. A cut-off trench about 5 feet deep and 8 feet wide in the bottom with side slopes of 1:1 was constructed under the upstream section of the dike and filled with compacted material. An emergency spillway of the open-channel type will be constructed near the upstream end of the dike.

The C. C. C. enrollees from the Bridgeland camp are engaged on a water conservation program of considerable magnitude. The principal items of work involved in the construction of the feeder canals are 330,000 cubic yards of excavation, all classes, and the building of 130 bridges, turn-outs, flumes, checks, and other concrete, rock-masonry and timber structures, this work now being approximately 85 percent completed. The principal items of work involved in the construction of the Midview Dam and appurtenant structures include 44,000 cubic yards of stripping in foundations and borrow pits; 230,000 cubic yards of excavation in borrow pits; 171,000 cubic yards of rolled embankments; 43,000 cubic yards of gravel and rock fill; 25,000 cubic yards of excavation in spillway channel, cut-off and drain trenches; 810 cubic yards of reinforced concrete and the placing of 70,000 pounds of reenforcing steel and miscellaneous metal, this work now being about 75 percent completed. The costs of materials and supplies in permanent structures, some heavy equipment, and skilled labor are being paid from project funds.

Detailed designs for all major structures were furnished by the Denver office, which office also furnished the detailed plans for the Midview Dam and related works, together with a memorandum of instructions for the use of the field engineer in supervising the construction of these features.

The construction program is carried on in the field by a dual organization. The C. C. C. camp superintendent has charge of the work activities and directs the supervisory, facilitating and enrollee personnel in carrying out the E. C. W. work program. The Bureau of Reclamation field engineer has charge of surveys, inspection, and other field engineering

work, and the construction of the various features is subject to his immediate supervision and approval. Both organizations operate directly under the supervision of the Salt Lake office of the Bureau. The relationship with the Army is the same as with the usual C. C. C. camp where the operation of the camp other than for the work program is under the supervision of the Army personnel.



CONCRETE CUTOFF WALL FOR MIDVIEW DAM CONSTRUCTED BY CCC ENROLLEES.

CONSTRUCTION METHODS

In constructing the canals, two 50-horsepower Diesel tractors with hydraulically operated trail-builder blades attached were used on the sidehill sections in benching out the top portion of the canals, after which the bottom portion was removed with two 8-cubic-yard wheeled scrapers, powered with 50-horsepower Diesel tractors. Excavation of the canals on level sections was done with the scrapers except in wet sections where a ½-cubic-yard dragline was used. A scarifier machine, powered with a 50-horsepower Diesel tractor, was engaged in loosening the earth and other materials in the canals.

In constructing the dam and dike, the wheeled scrapers were used in stripping the foundations and borrow pit areas. These machines and three or four small dump trucks were employed in transporting the material from the borrow pits to the embankments where the material was spread in 4- to 6-inch layers. In all cases the enrollees moistened the material by irrigating and sprinkling methods in the pits, and it was compacted in place in the embankments with the use of a sheep's-foot roller pulled by a 50-horsepower Diesel tractor. A ½-cubic-yard dragline was used in excavating the cut-off and toe-drain trenches in the dam foundation. These trenches, as well as the foundation, were unwatered by pumping from a sump into an outlet drain constructed below the dam. The sump was grouted when the embankment reached a height above the normal stream bed. A 160-cubic-foot compressor and two paving breakers were employed in excavating the cut-off trench into bedrock for the cut-off wall and in hand-tamping embankment materials where required. The concrete poured in the outlet works and cut-off wall, as well as in the canal structures, was manufactured in a concrete mixer. Concrete aggregates were obtained from river channel deposits near the C. C. C. camp where a small screening plant was installed for obtaining the desired sizes of sand and gravel.

In the placing of embankment materials in the dam and dike and the pouring of concrete in the various structures, the standard Bureau of Reclamation control methods were employed. A small field laboratory was used in making the usual field tests of borrow pit and embankment materials and concrete aggregates. The breaking of concrete cylinders was accomplished in the laboratory at the Moon Lake Dam.

The construction equipment has been kept in repair by maintaining a small shop at the camp for the repair of trucks, light automobiles, and for miscellaneous work. A large shop is at the Midview Dam for the repair of tractors and other heavy equipment, blacksmithing, cutting, and bending of reinforcing steel and the building of concrete forms.

Because the C. C. C. enrollees are not more than 17 to 19 years of age, on an average, and as most of them have had very little or no experience in construction or any kind of manual labor, the use of experienced foremen and skilled workmen has been found necessary in providing an opportunity for the enrollees to adapt themselves to the kind of work being done. It has been the practice, as far as possible, to train small groups of enrollees directed by one or two skilled workmen or foremen on the various types of work such as operation of tractors and other heavy machinery, building of structures, excavation, placing of embankments, and on other related work requiring skilled and semiskilled labor. Many of the enrollees have availed themselves of the opportunity of job training, and by reason of the experience gained on the work features, supplemented by class work at the camp pertaining to these features, have developed into efficient and competent workmen in the skilled and semiskilled jobs.

EXCAVATION OF DUCHESNE FEEDER CANAL WITH PNEUMATIC-TIRED SCRAPER. CCC ENROLLEES REMOVING ROCK AND TRIMMING SLOPES.

Reclamation Organization Activities and Project Visitors

Hon. Harold L. Ickes, Secretary of the Interior, delivered an address on the subject "Three Years of P. W. A." at the banquet given on February 17 in San Antonio, Tex., by the Associated General Contractors of America at their annual convention. On the 19th at Marshall Ford Dam site, about 18 miles from Austin, Tex., the Secretary delivered the principal address at the ceremony commemorating the commencement of work on Marshall Ford Dam. We hope to carry the address in full in the April issue of the "Era."

John C. Page, Commissioner of Reclamation, attended the Eighteenth annual convention of the Associated General Contractors of America, Inc., held at San Antonio, Tex., February 15–18. Mr. Page addressed the convention on the 17th on the subject "The need for water conservation and control." Following the convention Mr. Page visited the Carlsbad and Rio Grande projects.

R. F. Walter, chief engineer, and J. L. Savage, chief designing engineer, of the Denver office; Walker R. Young, construction engineer, Central Valley project, Sacramento, Calif.; R. B. Williams, construction engineer, All-American Canal, Yuma, Ariz.; H. W. Bashore, construction engineer, Casper-Alcova project, Casper, Wyo.; F. A. Banks, construction engineer, Columbia Basin project, Coulee Dam, Wash.; and Ralph Lowry, construction engineer, Boulder Canyon project, Boulder City, Nev., were called to Washington during January to discuss matters pertaining to reclamation. They had previously attended a meeting of the American Society of Civil Engineers in New York.

Hon. Roy O. West, former Secretary of the Interior, was a visitor in the Washington office on February 13.

Wesley R. Nelson, engineer in the Washington office, addressed the Hartford Engineers' Club at West Hartford, Conn., on the evening of February 23, on the subject of Grand Coulee Dam. Mr. Nelson's talk was illustrated with lantern slides and motion picture reels.

F. E. Weymouth, former chief engineer of the Bureau of Reclamation, called at the Washington office on February 15.

C. M. Day, Chief Mechanical Engineer, Denver, Dies

C. M. Day, chief mechanical engineer in the Bureau of Reclamation, died in Denver on January 20, having suffered for more than a year with a serious heart affection and resultant condition of poor health.

Mr. Day was born in Union, N. Y., August 17, 1878. After graduating from high school he attended the Newark Technical School for 2 years. Briefly, his professional experience was as follows: Mechanical draftsman, New York City, 1900–1904; engineer installation of steam power plant, Ocean Park, Calif., 1905; draftsman, maintenance of way, Salt Lake Railroad, 1905; draftsman United States Bureau of Reclamation, 1906; draftsman on airlift pumping plants, 1906; engineer on design and installation of timber treating plant for Salt Lake railroad, 1907–8; electrical assistant on design of gates, valves, and hoists, United States Bureau of Reclamation, 1908–10; salesman, mining and irrigation machinery in Arizona and west coast of Mexico, 1910; designing engineer, research work and design of oil gas producers and design and installation of gas producer power plants, 1911–12; with United States Bureau of Reclamation since August 1912 (except period from June 1915 to March 1916). Mechanical draftsman, design of gates, valves, hoists and hydroelectric power plants, 1912–15; senior draftsman to chief draftsman, mechanical-electrical section, chief engineer's office, 1916–18; engineer on supervision of mechanical designs, chief engineer's office, 1919–24; mechanical engineer in supervision of all mechanical engineering and inspection of materials, in chief engineer's office, Denver, Colo., since July 1924. Important work in the Bureau of Reclamation included the development and standardization of high-pressure gates and balanced needle valves for regulation of discharge of water from reservoirs under high heads. He was in charge of designing the welded steel penstocks for the Boulder Dam, the largest of this type ever constructed, as well as all other mechanical installations at that dam. He collaborated in the preparation of a report on High Pressure Reservoir Outlets by J. M. Gaylord and J. L. Savage, which was published as an official document by the United States Bureau of Reclamation.

Mr. Day was a member of the American Institute of Electrical Engineers; Colorado Motor Club; and Mount Vernon Country Club of Denver, Colo. He is survived by his widow, Mrs. Love C. Day, of 967 Marion Street, Denver, Colo.

F. Saturnino de Brito, consulting civil and mining engineer of Rio de Janeiro, Brazil, delegate to the Third World Power Congress held in Washington, D. C., in September 1936 subsequently visited a number of the Federal Reclamation projects, including Columbia Basin, Boulder Canyon, Yuma, All-American Canal, and Salt River. He stopped en route at Denver and was shown the operations of the various laboratories in the office of Chief Engineer Walter.

John W. Haw, of the Northern Pacific Railroad; R. W. Reynolds, of the Chicago, Milwaukee, St. Paul & Pacific; and E. C. Leedy, of the Great Northern, were among the recent visitors to the Washington office.

G. W. Grebe, Kuna, Idaho, president of the Federal Irrigation Congress, visited Washington early in February in the interest of his organization.

H. C. Schwalen, assistant agricultural engineer, and W. T. McGeorge, of the University of Arizona, Tucson, recently arrived on the Yuma project and began a field examination of the Mesa lands with reference to location of an experimental station for the Gila project.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page,** Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S Stuver, Asst. Gen. Supr. of Operation and Maintenance; A. R. Golzé, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal[1]	Yuma, Ariz	R. B Williams	Constr. engr.	I C. Thrailkill	R. J. Coffey	Los Angeles, Calif
Belle Fourche	Newell, S. Dak	F C Youngblutt	Superintendent	J P. Siebeneicher	W. J Burke	Billings, Mont.
Boise	Boise, Idaho	R J Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant[1]	Boulder City, Nev	Ralph Lowry	do	Gail H Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg	Clyde H Spencer	do		B E. Stoutemyer	Portland, Oreg
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Ft. Sumner, N. Mex	Wilfred W. Baker	Constr engr		do	Do.
Casper Alcova	Casper, Wyo	H W. Bashore	do	C M. Voyen	W. J Burke	Billings Mont
Central Valley	Sacramento, Calif	W. R. Young	do	E R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg
Deschutes	Bend, Oreg		Engineer		do	Do.
Frenchtown	Missoula, Mont	J. W. Taylor	Resident engr		W. J. Burke	Billings, Mont
Gila	Yuma, Ariz	R B Williams	Constr engr		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah
Humboldt	Reno, Nev	L. J Foster	Constr. engr	George B. Snow	do	Do
Klamath	Klamath Falls, Oreg	B. E. Hayden	Superintendent	W. I. Tingley	B E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont	H. V Hubbell	Constr. engr	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin[2]	Acting Supt	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	F. J. Westerhouse	Constr. engr	Francis J. Farrell	J R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo	C F. Gleason	Supt of power	A. T. Stimpfig	W. J Burke	Billings, Mont.
Ogden River	Ogden, Utah	J R Iakisch	Constr engr	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah
Orland	Orland, Calif	D L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam[3]	Parker Dam, Calif	E A. Moritz	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif
Pine River Vallecito Dam)	Durango, Colo	Charles A Burns	do		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex.	L. R. Fiock	Superintendent	H H. Berryhill	H. J. S. DeVries	El Paso, Tex
Caballo Dam	Caballo, N. Mex	S. F. Crecelius	Constr. engr		do	Do
Riverton	Riverton, Wyo	H. D Comstock	Superintendent	C B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz	E. C. Koppen	Constr. engr	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
Shoshone	Powell, Wyo	L. J Windle[2]	Superintendent	L J. Windle[2]	W. J. Burke	Billinga, Mont.
Heart Mountain	Cody, Wyo	Walter F Kemp	Constr. engr	do	do	Do.
Sun River Greenfields division	Fairfield, Mont	A W Walker	Superintendent		W J. Burke	Billings, Mont.
Truckee River Storage	Reno, Nev	L J Foster	Constr engr	Geo. B. Snow	J R Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg	C. I. Tice	Reservoir supt		B. E Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo	A. A. Whitmore	Engineer	Ewalt P Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo	C. B. Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage[4]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B E Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza div	do	Chas. E. Crownover	Constr. engr	Alex S. Harker	do	Do.
Yuma	Yuma Ariz	R. C. E Weber	Superintendent	Noble O Anderson	R. J. Coffey	Los Angeles Calif.

[1] Boulder Canyon. [2] Acting [3] Non-Federal. [4] Island Park and Grassy Lake dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M. Watson	Caldwell.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo	Charles Tharp	Superintendent	C. J. McCormich	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A	Wellsville, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr	President	Dorothy Eyers	Do.
Lower Yellowstone	Board of Control	Sidney Mont	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook division[1]	Alfalfa Valley irrigation district	Chinook, Mont	A L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O Fleenor	Superintendent	C. G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo	Bert L Adams	do	Mary Harrach	Torrington.
Northport division	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	Superintendent	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	H. J. Lawson	do	F. G. Henshaw	Phoenix.
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo	F. E. Martin	President	Geo. W. Atkins	Powell.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn	Payson, Utah	William Grotegut	President	E G Breeze	Payson
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	E. J. Gregory	Manager	E J Gregory	Fort Shaw.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D. Martin	Hermiston.
West division	West Extension irrigation district	Irrigon, Oreg	A. C Houghton	do	A. G. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W U A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J Frank Anderson	Montrose
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash	W. V. Russell	Manager	G. L Sterling	Ellensburg.

[1] Operated by 5 irrigation districts

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec 15	Denver, Colo	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash	F. A. Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo	Mills E. Bunger	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo	Frank C. Merriell	Do.
Black Hills	Rapid City, S Dak	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	Denver, Colo	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do
Conchas	Tucumcari, N. Mex	J. A. Keimig	Associate Engineer.
Grande Ronde	La Grande, Oreg	C. C. Fisher	Engineer.

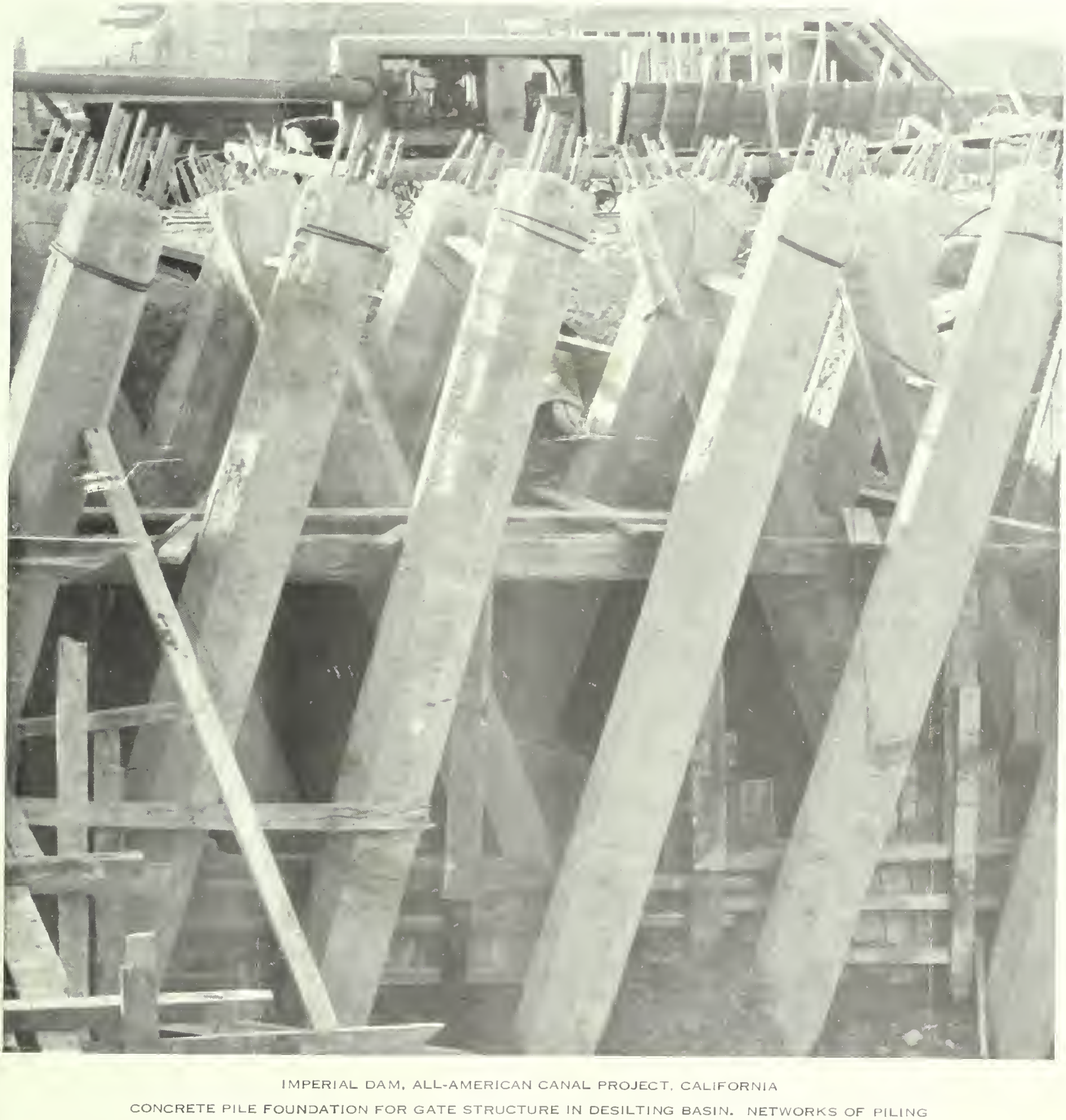
Sallie A. B. Coe, *Editor.*

PARKER DAM ON THE COLORADO RIVER, 155 MILES BELOW BOULDER DAM.

THIS IS THE UNWATERED SECTION OF THE COLORADO RIVER AT THE DAM SITE. THE VIEW WAS TAKEN LOOKING DOWNSTREAM FROM THE CALIFORNIA SIDE OF THE RIVER. PARKER DAM, WHICH WILL REREGULATE THE COLORADO RIVER BELOW LAKE MEAD AND WILL DIVERT WATER INTO THE AQUEDUCT OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA FOR TRANSMISSION TO LOS ANGELES, WILL BE A 340-FOOT CONCRETE ARCH STRUCTURE. IT WILL IMPOUND 700,000 ACRE-FEET OF WATER. A POWER

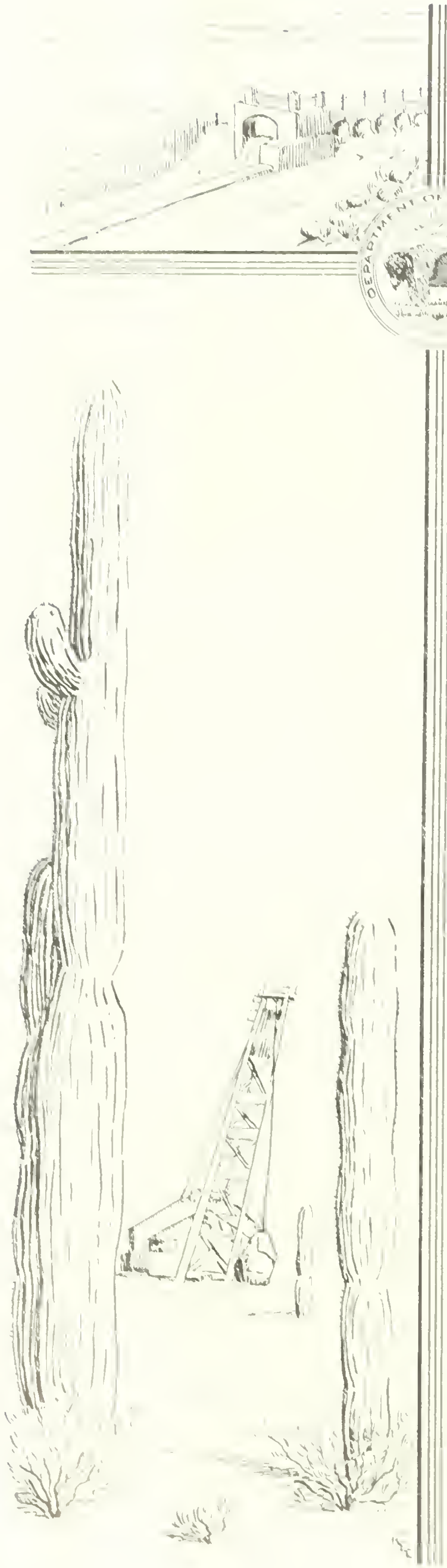
THE RECLAMATION ERA

VOL. 27, NO. 4 APRIL 1937



IMPERIAL DAM, ALL-AMERICAN CANAL PROJECT, CALIFORNIA

CONCRETE PILE FOUNDATION FOR GATE STRUCTURE IN DESILTING BASIN. NETWORKS OF PILING SUCH AS THIS STABILIZE VARIOUS FEATURES OF THE STRUCTURES.



THE RECLAMATION ERA

PRICE 75 CENTS A YEAR

HAROLD L. ICKES
SECRETARY OF THE INTERIOR

JOHN C. PAGE
COMMISSIONER, BUREAU OF RECLAMATION

CONTENTS

THE RECLAMATION ERA

The Reclamation Era, the monthly magazine of the Bureau of Reclamation, Department of the Interior, is sent to some 15,000 water users on the Federal Reclamation projects and to a paid subscribers' list of approximately 2,000 persons. The magazine has been issued by the Bureau since December 1907.

This publication serves as a medium through which the activities of the Service on all its projects are brought to the attention of the water users, bringing the individuals into close personal and sympathetic touch not only with the employees of the Service, but with their fellow water users on other projects. Each number aims to contain articles by experts in the Government Service and elsewhere, by the water users themselves, and by employees of the Service which shall serve to aid the settler to a higher standard of agriculture. It contains matter which has proved an economical and efficient means for disseminating important irrigation, engineering, agricultural, and official information to the water users on the projects and to others who are interested in the more technical articles concerning the engineering features and methods employed in their construction. Under the head "Notes for Contractors" contracting firms also are kept informed in the matter of contracts awarded.

The assistance of the magazine in improving agricultural management of the lands on the projects tends to increase the ability of the water users to repay the cost of construction of the projects. As the water users are an integral part of the Bureau of Reclamation, the ultimate success of the work of the Service depends upon the success of its water users.

Dedication of Marshall Ford Dam, Colorado River Project, Texas

Address delivered by Hon. Harold L. Ickes, Secretary of the Interior

WE ARE here today to celebrate the beginning of work on Marshall Ford Dam which will rise between these steep, rocky slopes.

The Colorado River, as it flows yonder in its channel, does not appear to be a particularly dangerous stream, but it is in fact one of the most treacherous and erratic rivers on this continent. Rising beyond the New Mexico boundary, the Colorado flows for 800 miles diagonally across Texas to discharge into Matagorda Bay. It extends from the arid zone, through many rainfall shadings to the humid zone.

This river has a history studded with destructive and unpredictable floods. It has claimed many lives and repeatedly has destroyed valuable property. To you who have your homes along the course of the Colorado River, the dam that we are to begin today will be a bulwark of a new security.

The great structure which is to rise here, when completed to its ultimate height, will pull the fangs of the stream. Once this work is done, the Colorado River no longer will be able to strike like a snake in the dark, but will be rendered practically harmless. It will even be made to perform useful work.

* * * * * * *

The President's interest in this program is more than academic. Earlier this month he recommended to the Congress for its consideration a comprehensive report by the National Resources Committee which outlined a 6-year program of construction in the field of control and conservation of water.

WATER PROBLEMS OF NATIONAL CONCERN

Every section and subsection of the United States has one or more serious water problems. For too long a time these have been considered from a regional standpoint and in the light of an emergency situation. A national approach has been needed. A polluted stream in Massachusetts, a flood in the Colorado River of Texas, the exhaustion of the underground water in the California Valley, or a dust storm in the Great Plains area, all vitally affect people in every part of the United States.

It is for the common good of our country that, as a people, we are coming more and more to recognize that we have a common destiny and that we must advance toward it with a united front.

1. SECRETARY OF THE INTERIOR HAROLD L. ICKES ADDRESSES THE CROWD AT GROUND BREAKING CEREMONY OF MARSHALL FORD DAM. ON HIS LEFT IS GOV. JAMES V. ALLRED OF TEXAS, AND ON HIS IMMEDIATE RIGHT, CONSTRUCTION ENGINEER HOWARD P. BUNGER.
2. THE CROWD AND SPEAKER'S STAND. ON THE OPPOSITE SIDE OF THE RIVER IS SEEN THE DAM BASELINE, CLEARED OF TREES AND BRUSH.

The construction of Marshall Ford Dam will constitute a service to Texas of national importance. Two severe droughts and two great floods since 1934 have thoroughly aroused the Nation. No longer do we as a people consider these catastrophes as the hard luck of someone else. We have learned that when catastrophe befalls one region it affects all others. Only in the degree of damage is there any difference.

It is a pleasure to me therefore, as a citizen, as Administrator of Public Works, and as Secretary of the Interior, to take part with you in these ceremonies. As an American citizen, I am glad that the National Government is recognizing its part in the responsibility to correct such situations as arise at irregular intervals when an uncontrolled river is left to its own devices. As Administrator, I rejoice that the Public Works Administration was able to provide the funds and thereby become an instrument for the solution of this particular problem and many like it in other areas, and as Secretary of the Interior, of which the Bureau of Reclamation is a part, I am gratified that that agency will have the responsible part that has been assigned to it in the actual construction of Marshall Ford Dam.

One has only to recall the flood which raged through this canyon in June of 1935 and the two which occurred last September to appreciate the size of the problem with which we are dealing here.

Records covering 35 years show that the average discharge of the Colorado River at Austin, 18 miles below this point, is about 1,184,000 gallons a minute. If this average flow were not exceeded, and if the volume of the river were not variable from year to year, from month to month, and almost from day to day, there would be no problem here to be solved.

The average flow was multiplied 200 times by the flashy flood of June 1935, when in 2 hours and a half the river rose 20 feet at Austin. At the peak, 216,450,000 gallons a minute passed Austin, and wreckage, including whole houses, was carried over Austin Dam.

The two floods which followed last September in 10 days sent almost twice as much water rushing down to the sea as the Colorado River produces on an average in a year.

It is perfectly obvious what such remarkable variations in the flow of this stream must mean to those living in its valley. Floods are likely to develop at almost any time of the year. Given a sudden storm in the rough country of the

Concho River watershed, and in 72 hours the Colorado River is in flood at this point; a heavy rain in the Llano or the Pedernales watershed, and in 24 hours the Colorado River has changed from a creek to a boiling torrent at Austin. Until this river is controlled such dangers will ever be present. High hopes are held that Marshall Ford Dam and the other structures of the Colorado River of Texas project will provide the necessary control.

MARSHALL FORD DAM TO CORRECT FLOOD HAZARD

Marshall Ford Dam will be constructed in two stages of which we are beginning the first today. It will be a concrete dam of the straight gravity type, 190 feet high and 2,325 feet wide at the crest. A 30-foot embankment 1,100 feet long will be constructed at the left abutment. This dam will create a reservoir of a capacity of 600,000 acre-feet and will be completed in less than 3 years. The ultimate plans call for the construction of a higher dam, which will reach to 265 feet at this point and into which the low dam will be incorporated. The high dam will provide storage for 3,000,000 acre-feet of water. When it is completed, there is every reason to expect that the flood hazard along the lower course of the Colorado River will be reduced to a minimum.

A contract has been awarded covering the first stage, calling for the expenditure of $5,781,235. This work will be under the general supervision of experienced Bureau of Reclamation engineers, represented locally by Construction Engineer H. P. Bunger. The Bureau of Reclamation brings to this work an enviable record as a builder of sound and successful dams. I am confident that it will be able to maintain that record.

I assume that most of you are familiar with the plans of the Lower Colorado River Authority for this project, so that I will only review briefly the manner in which the funds necessary to undertake the work were made available.

Thanks largely to the interest and energy of Congressman Buchanan, Representative in Congress, an allotment of $20,000,000 was made in 1935 by the Public Works Administration. Of this amount, $5,000,000 has gone to the Bureau of Reclamation to be used in the construction of Marshall Ford Dam. This sum capitalizes Federal responsibility for the control of the floods of the Colorado River in Texas. Fifteen millions were apportioned to the Lower Colorado River Authority, $4 500,000 of which was a grant and the remainder a loan. This money is being used in the construction of other phases of the project.

When Marshall Ford Dam is completed to its full height, it will also serve purposes incidental to flood control but none the less valuable on that account. It will make available a water supply which can be used to supplement the irrigation of as many as 300,000 acres of land along the lower river. It will also serve a power house with a generator capacity of 60,000 kilowatts.

It is to such multiple-purpose projects as this that we are turning as a Nation in our fight to conserve our natural resources and thus preserve and maintain the civilization that we have built.

There are many other projects in various parts of the country intended, as is Marshall Ford Dam, to meet some particular and immediate need but which will serve also to conserve a resource and enrich our civilization.

OTHER RECLAMATION STRUCTURES

The Bureau of Reclamation, which will supervise this job, is constructing several other projects of this type in different parts of the West. For example, it has completed one, Boulder Dam, on that other Colorado River, which is longer than this stream but which otherwise formerly resembled it in that it too was dangerous, turbid, and unreliable.

All of us are more or less familiar with Boulder Dam and the services that it is performing. Just this month the installation of the fourth great generator was completed in the Boulder Dam power house. In January more than 82,000,000 kilowatt-hours of electric energy were produced there. The production of a great volume of cheap power at Boulder Dam will mean much to the future development of its surrounding area.

Although the income from this power will repay the entire cost of the project, Boulder Dam is not strictly nor solely a power project. The production of hydroelectric energy at Boulder Dam is incidental to its principal purpose, which is the regulation of the great Colorado River. Already there is stored in Lake Mead, now nearly 100 miles long, almost 10,000,000 acre-feet of water; enough to cover 10,000,000 acres to a depth of 1 foot. This water would have been wasted in destructive floods except for Boulder Dam, but now it is being saved for the use of irrigators and of cities in the deserts of Arizona and California.

In addition to Boulder Dam, which furnishes a good text on this occasion because it is an accomplished fact, more than a score of projects that are similar to it and to this one are under construction by the Bureau of Reclamation. These include the Grand Coulee Dam and Columbia Basin project on the Columbia River in Washington, one of the most interesting and provocative developments so far undertaken by man, and the Central Valley project in California, which is designed to correct two major water problems and thus prevent the ruin of almost 1,000,000 acres of the most highly developed and productive agricultural land in that State.

While the benefits which will result from these big projects will be spread over wider areas, many other Federal Reclamation undertakings, although their scope is more limited, will prove as valuable to their communities as the ones that I have named.

The Central Valley project will provide a better distribution of the waters of the Sacramento and San Joaquin watersheds in California. Here, two valleys, named for the rivers which drain them, in effect form one great semiarid interior valley 600 miles long in the heart of California. Central Valley, as it is called, is surrounded by mountains except for the break at San Francisco Bay, through which the Sacramento and San Joaquin Rivers, combined, flow to the sea.

The Sacramento River, rising in the north, produces a great volume of water but, like the Colorado here, it is subject to wide variations in flow. The San Joaquin River, rising in the south, does not produce sufficient water for the needs of the area that it drains.

Two pressing problems affect the Central Valley. One is that underground water is being exhausted in the southern San Joaquin Valley and 400,000 acres of farms are in process of reverting to desert. The other is that the fertile San Joaquin-Sacramento delta, containing another 400,000 acres, is threatened with distruction by the intrusion of salt water from San Francisco Bay.

A large storage dam has been designed for construction on the Sacramento River, which will serve the purposes which Marshall Ford Dam will carry out on the Colorado River here in Texas. The dam on the Sacramento River at Kennett will store the flood waters of that stream so that they can be released at a uniform rate and thereby permit the diversion of an adequate water supply into the San Joaquin Valley. It will also provide a sufficient flow through the delta to wash out the sea water and keep the irrigation channels of that area free from salt.

The Central Valley project, because of the complexity of the problems which it seeks to solve, is an ambitious undertaking. It will, however, be self-liquidating and its cost will be repaid to the Government by those who will benefit from its construction.

The Columbia Basin project, of which the Grand Coulee Dam is the principal engineering feature, is of a slightly different type. Its construction will provide a reliable water supply for the irrigation of 1,200,000 of dry but potentially highly productive acres in the Big Bend country of eastern Washington. The Columbia Basin project is a long-range one. Its development probably will extend over a period of four or five decades. When completed it will make possible the cultivation of what is probably the largest and finest tract of undeveloped land remaining in the world, in addition to producing a large quantity of cheap electric power. The promise that it holds for increased national wealth is unequalled, I believe, by any other project.

These projects, like the one that is being inaugurated here today, are national improvements which cannot be measured solely in terms of the benefits which are to flow to their immediate areas. Without such undertakings the West and Southwest lack economic security. Without them, the development of these great regions cannot go forward and they can never hope to reach full maturity.

It is important to all of us, wherever our homes may be, that the Colorado River of Texas should be controlled and that these other problems which we must face as a Nation should be solved. But we cannot cope successfully with such national problems as I have indicated except on the basis of a broad, national policy. Floods, droughts, and eroding winds do not recognize State lines and we cannot hope to do anything very much about them unless the people have that freedom of action which is necessary in the interest of the country as an integrated Nation that is bound together in a common destiny.

Ground Breaking Ceremony at Marshall Ford Dam

THE Colorado River of Texas is not so widely known as is the river bearing the same name which flows into the Gulf of California. However, its characteristics are much the same. It is quite as treacherous and erratic, and its flow varies even more widely than the other Colorado. Last and greatest step in a scheme to harness this sometimes rampant river is construction of the Marshall Ford Dam, 22 miles upstream from Austin, the capital city of Texas. The general plan for this structure provides for progressive development involving two principal stages of construction. The first development consists of a dam 190 feet high. The final development contemplates raising the 190-foot structure to a maximum height of 265 feet. The completion of the low dam will afford partial protection to Austin and smaller cities on the lower river and to valuable rice lands on the coastal plain from floods such as the devastating 500,000 second-foot flood of June 1935. To insure full protection from all floods originating above Austin, completion of the dam to its full height will be required.

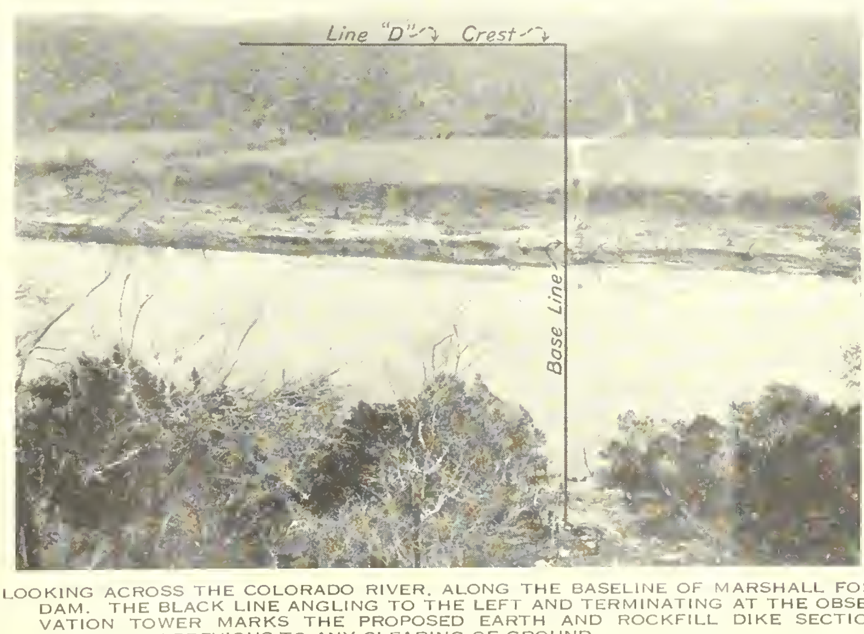
On Friday, February 19, Secretary of the Interior Harold L. Ickes on his first visit to Texas P. W. A. projects, touched off the first blast on the rugged north bank of the Colorado River, initiating actual construction on the million-cubic-yard concrete-gravity structure. On the previous day, the Secretary had addressed a convention of the Associated General Contractors of America at San Antonio. He was met in San Antonio and escorted by automobile to the Colorado River project, and, after a brief visit to P. W. A. project dams nos. 1 and 2, arrived at the Marshall Ford dam site at 4 p. m. He was greeted there by a throng of 1,500 people, most of whom were citizens of Austin and the surrounding country who had gathered for the ceremony.

On the speaker's stand which was equipped with an efficient public-address system, the Secretary met Howard P. Bunger, construction engineer for the Bureau of Reclamation, James V. Allred, Governor of Texas, Tom Miller, Mayor of Austin, and various engineers from the State construction agencies. Before his speech, the Secretary was presented with a silver and mahogany plaque in commemoration of his service to the project and his present visit to central Texas flood-control projects.

SECRETARY PAYS TRIBUTE TO RECLAMATION ENGINEERS

While a Paramount news camera recorded the scene, Secretary Ickes gave tribute to the Bureau of Reclamation for its enviable reputation as a designer and builder of dams. He told of the wide range of work performed by the Bureau and described some of the larger projects that are now under construction or have been completed recently. Briefly outlining the national policy of flood control, the Secretary pointed out that serious water problems have been considered too long from a regional standpoint and that in the light of an emergency situation a national approach is needed. He said in the Keynote of his address: "A polluted stream in Massachusetts, a flood in the Colorado River of Texas, the exhaustion of the underground water in the California Valley, or a dust storm in the Great Plains area, all vitally affect people in every part of the United States. It is for our common good to advance on a united front.

(Continued on p. 73)



LOOKING ACROSS THE COLORADO RIVER, ALONG THE BASELINE OF MARSHALL FORD DAM. THE BLACK LINE ANGLING TO THE LEFT AND TERMINATING AT THE OBSERVATION TOWER MARKS THE PROPOSED EARTH AND ROCKFILL DIKE SECTION. VIEW TAKEN PREVIOUS TO ANY CLEARING OF GROUND.

The Reclamation Era

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

APRIL 1937

Planning Your Vacation

It is not too early to think about how you will spend the leisure time of your vacation period. Paper planning is a lot of fun and everyone who enjoys this indoor sport appreciates knowing of new places to go.

HOW ABOUT BOULDER DAM?

Everybody thinks of Boulder Dam in terms of flood control, power, and irrigation, but I wonder how many think of it in terms of vacation ground. The spring and fall of the year at Boulder Dam are ideal. We are now working on the establishment of tourist accommodations. Recognizing the prevalence of trailers on the road, we will have a trailer camp in addition to the regular quarters for tourists traveling in their automobiles only or by train. Accommodations are available to suit your pocketbook. You can stop at one of the hotels at Las Vegas, 30 miles from Boulder Dam, which is the terminus of the railroad, and make trips out of there; you can move on to Boulder City, 7 miles from Boulder Dam, which is the headquarters town for administration of this project, and stop at its fine air-cooled hotel, or, if you prefer, you may occupy a cottage in one of the tourist camps. Our plans call for establishment of one at Boulder City, and the National Park Service, which has supervision of the recreational area around Lake Mead, has plans for accommodations similar to those established in National Park areas.

The trailer camps should be quite an inducement to travelers to the coast or travelers on the coast desiring to make trips out of California to nearby points of interest. A trip from Lower California to Boulder Dam can be made by way of Death Valley, thus making this trip a double attraction.

WHAT DOES BOULDER DAM AREA OFFER?

Boulder Dam is not just another dam. It is the highest dam in the world. It is in a narrow canyon known as Black Canyon and is 726 feet high. It is 660 feet thick at the base.

One of the most attractive things I have seen recently is a book of comparisons on Boulder Dam issued by the Boulder Dam Service Bureau. It contains, in graphic form and by the clever use of line drawings, very interesting national and international comparisons of height with this structure. Comparisons begin with the Empire State Building, the world's tallest building located in New York City, 1,248 feet; Eiffel Tower in Paris, 984 feet; Washington Monument in the District of Columbia, 555 feet; and, rather dwarfing the lowest dimension given, Westminster Tower in London, 310 feet.

By special permission of the Boulder Dam Service Bureau which has copyrighted this pamphlet, reprint is made of some interesting statements of benefits to other sections of the country by its purchasing power, creating demand for service in the form of all types of transportation and the furnishing of materials, and considerably relieving unemployment.

QUANTITIES USED ALL IN SUPERLATIVE

We may say 4,400,000 cubic yards of concrete were used in Boulder Dam and appurtenant structures and this awe-inspiring figure could immediately be analyzed by the technically trained mind, but when we say that so much concrete would be sufficient to build a concrete walk 42 inches wide and 2¾ inches thick entirely around the earth at the Equator, the layman's mind has a better conception of what a tremendous engineering achievement is recorded in the building of Boulder Dam.

Construction would have been considerably slowed up with the pouring of such a mass volume of concrete because of the generation of a tremendous force of heat and this heat would have created cracks and weakened the dam. It is estimated that half a million loaves of bread a day could be baked with the heat that was generated by the setting concrete in Boulder Dam. However, artificial cooling was resorted to and 582 miles of 1-inch piping was built right into the dam and cold water kept continuously running through it. This represents enough pipe to build three full-size replicas of the famous Eiffel Tower.

If dirt, moved in the construction of the dam, were handled by huge dump trucks, there would be enough loads to form continuous, simultaneous truck parades from Boulder City, Nev., to New York, New Orleans, San Francisco, Seattle, and Chicago.

These and many other interesting comparisons bring home to the average reader the tremendous engineering problems confronting the Government and the contractors in the building of the highest dam in the world.

BOULDER DAM AREA—A VACATION GROUND

What could be nicer than placing Boulder Dam on your itinerary for a visit to the coast? After you have viewed this mammoth dam, take a ride on Lake Mead, which has a shore line of 550 miles in Nevada and Arizona, or relax on its banks. A trip by an official photographer of the Bureau brought to us photographs of waterfalls and views along

(Cut along this line)

Commissioner,
Bureau of Reclamation,
Washington, D. C. (Date) ____________

Sir: I am enclosing my check[1] (or money order) for 75 cents to pay for a year's subscription to The Reclamation Era.

Very truly yours,

(Name) ____________

(Address) ____________

[1] Do not send stamps.

Note.—30 cents postal charge should be added for foreign subscriptions.

the shore of Lake Mead that are National Park caliber.

Lake Mead is truly a scenic gem in this desert country. The interesting history of the project and control of what has been a very destructive river is the story told by the guides who take care of visitors through Boulder Dam. Foreign visitors have traveled thousands of miles to see this engineering triumph. I have to hear the first expression that anyone was disappointed. On the contrary, there is always an expressed surprise that Boulder Dam and its surroundings offer much more than what is generally known by the traveling public.

These days, you hear a great deal about national planning of water resources. Here you see a project planned for years, and constructed under a State compact, signed by six of the seven basin States which contribute to the drainage basin of the Colorado River, a project economically sound because contracts for the sale of power developed at Boulder Dam were signed before construction started. These contracts insure the return of the Government's investment in the dam and powerhouse by return of this cost over a period of 50 years at 4 percent interest. *M. A. Schnurr.*

Slides on Irrigation Available to Schools

Owing to the many inquiries from project superintendents and school officials, the Bureau of Reclamation wishes to announce that the current slide lecture "New Ideas in Irrigation Agriculture" is available to high schools and colleges. These slides, accompanied by a printed lecture, present practical lessons in irrigation farming, including fundamental principles in irrigation practices, plans for land use, noxious weeds found on irrigation projects, and effective methods for controlling and eradicating damaging perennial weeds. Pictures for this series were photographed during the summer of 1936 and represent a summary of the latest findings on the subjects presented. Schools or extension study groups desiring to borrow these slides, may have them in the order of request merely by payment of express charges. Request for the slides should be made to the Commissioner, Bureau of Reclamation, Washington, D. C.

A NUMBER of farms have been sold recently on the North Platte project at prices ranging around $100 per acre for well improved places where the soil is of high quality.

Dr. Cory Addresses Engineers

Dr. H. T. Cory, noted engineer and professor, former associate engineer in the Bureau of Reclamation, spoke on "The Imperial Valley Past, Present, and Future", at the joint meeting on Wednesday evening, March 3, 1937, of the Washington Society of Engineers and the District of Columbia section, American Society of Civil Engineers, held at the Cosmos Club in Washington.

Dr. Cory was with the Southern Pacific Railway when the Colorado River broke through its west bank near the Imperial Valley Irrigation Co.'s intake and was diverted into Salton Sea, instead of flowing through its former channel leading to the Gulf of California. After 16 months the Southern Pacific Railway was called on to close the break. This was done under the direction of Dr. Cory, who has an international background, extending into Egypt, Spain, and Mexico, and has to his credit a wide, varied general practice, including recent assignments with the War Department, the Bureau of Reclamation, and the Soil Conservation Service.

Marshall Ford Dam Ceremony

(Continued from p. 71)

"Construction of Marshall Ford Dam will constitute a service to Texas of national importance. Two severe droughts and two great floods since 1934 have thoroughly aroused the Nation. No longer do we, as a people, consider these catastrophes as the hard luck of someone else. We have learned that when datastrophe befalls one region, it affects all others. Only in the degree of damage is there any difference.

"It is a pleasure to me therefore, as a citizen, as Administrator of Public Works, and as Secretary of the Interior, to take part with you in these ceremonies. As an American citizen, I am glad the National Government is recognizing its responsibility to correct such situations as arise at irregular intervals when an uncontrolled river is left to its own devices. As Administrator, I rejoice that the Public Works Administration was able to provide the funds and thereby become an instrument for the solution of this particular problem and many like it in other areas, and as Secretary of the Interior, of which the Bureau of Reclamation is a part, I am gratified that that agency will have the responsible part that has been assigned to it in the actual construction of Marshall Ford Dam."

With these closing remarks, the Secretary pressed a plunger making electrical contact which set off a charge of dynamite on the opposite side of the river, thus signalizing the first move toward construction of this all-important feature of the Colorado River project.

Immediately following the ceremony, the Secretary attended an informal dinner given in his honor at Austin. Later that night he addressed a joint session of the State Legislature. He entrained for St. Louis on the following morning, leaving with the citizens in this section of the country a better understanding of the Government policies and of the national scope of Marshall Ford Dam.

Electric Water Heater at Boulder Dam

What is, in effect, the largest electric water heater ever devised by man is in use at Boulder Dam in connection with the testing of the huge 115,000-horsepower generators now being put into operation there by the Bureau of Reclamation, Department of Interior.

In principle this heater, which is really a water rheostat of high capacity, is comparable to the small household heater used to warm junior's milk bottle in the wee hours of the morning. But, instead of using a mere 110 volts as does the average household heater, the Boulder Dam unit absorbs current potentials up to 18,600 volts.

The purpose of the rheostat is to absorb the current generated during tests and while the operation of the generators is being observed under varying conditions of hydrostatic head or pressure. The rheostat consists of three poles to conduct the current of the three-phase cycle into the water of the power-house tailrace which furnishes the resistance required to absorb it. The further the poles are submerged, the greater the resistance set up, thus affording the engineers the opportunity for observing the behavior of the generating unit under all conditions.

In order to accomplish this purpose with precision a chemical analysis of the water was made to determine its conducting properties and the resistance it would afford.

Fish swimming into the field of the rheostat are apparently electrocuted and float to the surface, but once the current is turned off or they float out of the charged field, they regain life and swim away quite unaffected by the experience of having tangled with the electric energy generated by the largest power plant in the world.

PARKER DAM PROJECT, CALIFORNIA.

1. FOUNDATION EXCAVATION. DRAGLINE IN LOWER CENTER LOADING CABLEWAY SKIP.
2. COMPLETED LOWER COFFERDAM FILL IN CENTER. DISCHARGE FROM PUMPS AT LEFT.
3. THE TWO MOVABLE TOWERS OF THE CABLEWAY WITH SINGLE FIXED TOWER.

Parker Dam, Half Completed, Serves Useful Purpose

A dramatic and successful fight at Parker Dam against a flashy rise in the Colorado River was detailed in a recent report by the Bureau of Reclamation to Secretary of Interior Harold L. Ickes.

Just north of Parker dam site the Bill Williams Fork joins the Colorado River. This stream, like many of the streams in the arid West, generally is dry but on occasions rampages with sudden floods which may rise in an hour and pass in a day. On February 7, following a warm rain of unusual intensity in northern Arizona, the Bill Williams Fork went on one of its dangerous and unpredictable rampages.

At 10 o'clock the flow of the river was negligible. By midafternoon it had reached a flow of 33,750,000 gallons per minute. At one period the river rose more than 2 feet in 5 minutes.

Excavation for the foundation of Parker Dam, under construction by the Bureau of Reclamation, was in progress behind two temporary cofferdams by which the Colorado River was diverted to flow through two tunnels, each 29 feet in diameter and 1,730 feet long. These cofferdams immediately were put to an unusual test. At stake was an investment in the cofferdams alone of more than $2,000,000.

The contractor hurriedly concentrated his equipment on the crest of the downstream cofferdam to erect an embankment and increase its height. The water rose to within a few feet of the top of the cofferdams, more than 50,000 acre-feet being impounded above the dam site, since the diversion tunnels could carry at capacity only about four-sevenths of the peak flow during the flood of the Bill Williams River.

The cofferdams proved equal to their test. Damage at Parker dam site was confined to the loss of a truck and an automobile and the destruction of a construction bridge and part of a construction road between the gravel pit near the mouth of the Bill Williams River and the dam site.

E. A. Moritz, Bureau of Reclamation construction engineer in charge of Parker Dam, said: "Two of our inspectors and a number of contractor's men were marooned at the gravel pit. They were brought back to camp the next day by boat across the reservoir. One workman was caught 12 miles up Bill Williams River on a hunting trip. He floated down on a log and, fortunately, floated past a crew of men who fished him out before he reached the tunnels, through which a boiling torrent was pouring. His new car went the way of all things in the

path of a violent flood and no trace of it has been found since.

"The flood waters brought down an immense amount of debris. Big trees—roots, branches and all—passed through the tunnels, as well as all of the contractor's Bill Williams River construction bridge. One deck section 30 feet long continued down the river."

When the flood reached Parker dam site almost without warning, word was sent immediately down to Yuma, Ariz., near where Imperial Dam, which heads the All-American Canal, was under construction. With this warning, preparations were completed at the Imperial dam site in time to prevent damage.

The Colorado River below Parker Dam was in poor condition to carry such a flood because of several years of very low flow. Had the full violence of the flood not been taken by the cofferdams at the Parker dam site, undoubtedly some damage would have resulted downstream. Thus, although Parker Dam is not yet half completed, it has served a valuable purpose in flood control by cutting almost in half the peak flow resulting from an unprecedented rise in the Bill Williams River.

Washoe County, Nev., Issues Bonds for Boca Dam

In Reno, Nev., on February 17, a brief ceremony was made of the act of handing to officials of the Washoe County Water Conservation District a bundle of bonds worth $500,000 by officials of Washoe County.

This ceremony marked the first time in the history of the United States Bureau of Reclamation that a county in which a project was to be built made a direct contribution toward the repayment of the cost of construction.

The Truckee River storage project, of which Boca Dam on the Little Truckee River will be the major engineering feature, will serve, when completed, to supplement the irrigation supply for 28,000 acres in the Reno Valley and 7,000 acres under the Truckee Canal. The project will be constructed with an allotment of $1,000,000 made by the Public Works Administration. The Washoe County Water Conservation District has contracted to repay the cost.

Believing that the construction of the project would benefit the cities of Sparks and Reno in Washoe County, as well as the agricultural area within the project boundaries, the Nevada State Legislature on February 28, 1935, authorized Washoe County to issue bonds valued at $500,000 to assist the farmers in repaying the cost of the project.

It has long been recognized that the benefits accruing from irrigation are reflected in the towns and cities of and adjacent to the project.

The action taken by the Nevada Legislature and by the Washoe County Commissioners, however, is the first by which the cost of a project is spread to the broader base.

The bonds issued are numbered consecutively from 1 to 37. They do not bear interest. Thirty-six of them call for payments of $13,500 each. The last, no. 37, calls for payment of $14,000. The first becomes payable by the County of Washoe February 15, 1940, and one becomes payable on that date of each succeeding year until the last is payable on February 15, 1976.

Repayment contracts and an agreement between the United States and water users known as the Truckee River agreement have been executed, and the contract for construction of Boca Dam has been awarded to the George W. Condon Co., of Omaha, Nebr., which bid $729,435. This was the lowest of 18 proposals received by the Bureau of Reclamation.

LEFT TO RIGHT: AL BLUNDELL, COUNTY COMMISSIONER; L. J. FOSTER, CONSTRUCTION ENGINEER, BUREAU OF RECLAMATION; GEORGE FERRIS, SECRETARY, IRRIGATION DISTRICT BOARD; CHRISTENSEN, PICKETT, JAMES PECKHAM, MEMBERS OF THE BOARD OF COMMISSIONERS; D. W. DUNKLE, COUNTY TREASURER; AND E. H. BEEMER, COUNTY CLERK.

Reclamation Laws Annotated

Federal reclamation laws annotated.—By Margaret G. Young, Legal Division, Bureau of Reclamation; 700 pages, 6 by 9 inches, with index, July 1936. Price, $1.25 paper cover, $1.50 cloth-bound. For sale by Bureau of Reclamation, Washington, D. C.

This is the fourth edition of this comprehensive publication on the Reclamation laws. The first edition was issued in 1920 and other editions were issued in 1927 and 1931, with supplements to bring each edition up to date.

The work is brought to July 1936, and contains a chronological compilation of the 299 Federal statutes under which the Bureau of Reclamation operates, with notes of decisions of the courts, the Comptroller General, the Attorney General, the Department of the Interior, and the Bureau of Reclamation.

STATION KOBH of Rapid City, S. Dak., sponsored a Newell hour on February 14, and local citizens took advantage of the opportunity to boost for this section, particularly the Belle Fourche irrigation project.

THERE were a number of inquiries and a number of prospective settlers at the Vale project office during February relative to land on the project. Three sales, representing 200 acres of land on the Willow Creek unit, were reported during that month.

PURCHASE of farm equipment and buildings materials on the Klamath project during January and February was at least three times greater than during the same period a year ago, one dealer reporting sales five times greater than those of a year ago.

Federal Condemnation of Land for Dam Site on Navigable River of United States

THE recent decision of the Circuit Court of Appeals for the Ninth Circuit in *Continental Land Company* v. *United States* is of such importance that the full text of the decision is given below.

Before: Garrecht, Haney, circuit judges; Neterer, district judge.

"The United States seeks to determine compensation to be paid for lands described in the petition appropriated by it pursuant to act of Congress June 17, 1902 (32 Stat. 388), 'An act appropriating the receipts from the sale and disposal of public lands in certain States and Territories to the construction of irrigation works for the reclamation of arid lands.' The Secretary of the Interior, as such official and as Federal Emergency Administrator of Public Works, pursuant to act of June 16, 1933 (48 Stat. 195), 'An act to encourage national industrial recovery, to foster fair competition, and to provide for the construction of certain useful public works, and for other purposes', has caused surveys and investigations to be made of the Columbia Basin project on the Columbia River having for its purpose 'regulation of the flow of said stream by storage reservoirs' and 'coordinated development and use of said stream for the various purposes for which it is adapted, including navigation, hydroelectric power, flood control and irrigation, including irrigation of public lands of the United States.' The said surveys and investigations so made having particular reference to immediate plans for construction of a dam across the Columbia River at the head or near the Grand Coulee. The said dam is to constitute the first unit and an integral part of a larger Grand Coulee Dam, which will form a basis of the complete Columbia Basin project and serve as the diversion dam, and also as principal storage reservoir to regulate the flow of the Columbia River for flood control and will serve the purposes of navigation and power development at all points on such stream below the Grand Coulee Dam. The Corps of Engineers, United States Army, under appropriations made by the Congress for that purpose, have conducted investigations for the purpose of determining the best use of the waters of the Columbia River and its tributaries for the purposes to which adapted and have adopted a coordinated plan for the development and use of the Columbia River for navigation, flood control, and irrigation, and for the development of electrical energy to pay the cost of the proposed construction, and for irrigation, industrial and domestic use. The said plan includes the construction of various dams at different points on the Columbia River, the uppermost of which is the Grand Coulee Dam, which is the key structure and will provide the necessary storage capacity to store the peaks of the Columbia River waters by storing the floods and releasing the waters stored during the low water season, and will improve the flow of said river for navigation, power, and irrigation and will reduce the flood dangers on its lower part. The estimate shows that the storage to be made available behind the Grand Coulee Dam will double (approximately) the amount of firm power which can be developed at each of the proposed dam sites between the Grand Coulee and the mouth of the Snake River and will increase by about 50 percent the amount of firm power which can be developed at each of the dam sites below the mouth of the Snake River, and that the increased amount of the firm power so made possible by reason of the storage behind the Grand Coulee Dam is an important factor in the feasibility of each of said lower dams as a self-liquidating project. Pursuant to the provisions of the act of June 16, 1933, supra, the Emergency Public Works Board and the Emergency Public Works Administration, under the authority of the President of the United States, allocated for the construction of said first unit dam and appurtenant structures from the emergency Public Works fund available, a sum of money estimated as sufficient to construct said dam and acquire the necessary rights-of-way therefor, and pursuant thereto the Secretary of the Interior and Emergency Public Works Administrator have authorized the construction of said dam and the reservoir to be formed thereby and the acquisition of the necessary rights-of-way therefor."

The testimony tends to show that the proposed dam at the present will serve the purposes of a diversion dam for the Columbia Basin project, the improvement of navigation by creating a lake 150 miles long, running from the dam to the Canadian border and by regulation of the flow of the river and increasing it, will improve navigation all the way from the dam site to the coast; that the foundation, including construction of 200 feet below the high-water line of the river, is necessary before any head can be secured for power development purposes. The cost of putting in the foundation before any head is secured for power development purposes is about $60,000,000. The completed structure will cost $197,000,000. The nearest tribal land of the Colville Indian Reservation is half a mile above the dam. This reservation extends along the side of the river for over 100 miles. It is not possible to construct a dam at that site without flooding both the allotted and the tribal lands of the Colville Indian Reservation. The Spokane Indian Reservation land will likewise be flooded by the back waters.

The Rivers and Harbors Act of August 30, 1935 (49 Stat. 1039), then pending before Congress and which shortly became a law, contained this provision:

"That for the purpose of controlling floods, improving navigation, regulating the flow of the streams of the United States providing for storage and for the delivery of the stored waters thereof, for the reclamation of public lands and Indian reservations, and other beneficial uses, and for the generation of electric energy

as a means of financially aiding and assisting such undertakings, the projects known as 'Parker Dam' on the Colorado River and 'Grand Coulee Dam' on the Columbia River, are hereby authorized and adopted, and all contracts and agreements which have been executed in connection therewith are hereby validated and ratified, and the President, acting through such agents as he may designate, is hereby authorized to construct, operate, and maintain dams, structures, canals, and incidental works necessary to such projects, and in connection therewith to make and enter into any and all necessary contracts, including contracts amendatory of or supplemental to those hereby validated and ratified."

It was stipulated at the trial that the backwater from the Grand Coulee Dam, now under construction, will flood about 18,000 acres of privately owned land, divided into 600 tracts and in 900 different ownerships; also some public lands of the United States, including both tribal and allotted lands. That prior to commencing this proceeding the Columbia Basin Commission secured a permit to appropriate under the State law 100,000 second-feet of the water of the Columbia River for use in connection with the Columbia Basin project, and it will assign such permit to the United States for the purposes of this project. That the lands which will be flooded by the backwaters of the dam also include uplands and riparian lands of the State of Washington, and lands in the bed of the stream. That on January 4, 1934, the Secretary of the Interior filed with the State Commissioner of Public Lands of the State of Washington a list showing the various tracts of State lands to be used in whole or in part for the purposes of said project; and that the dam, for all purposes, is situate on the only feasible dam site on the Columbia River.

The physical structure of the river bed adjoining the lands is a granite formation and entirely suitable for a dam. The banks of the river have a particularly suitable granite formation. The top of the dam when completed will be approximately 4,200 feet in length, and 1,800 or 1,900 feet of the dam on each side of the river will rest upon the appellants' uplands. The consulting engineer of the Government said it would not be feasible for private capital to develop the Grand Coulee project.

Another hydraulic engineer for the Government said the development of the Grand Coulee by private capital would not be feasible.

The hydraulic engineer for appellants said that the inherent adaptability and peculiar fitness of the appellants' land for use as a dam site was in the granite dike which has been cut by the Columbia River to a depth of 600 feet, which does not exist elsewhere on the river. From the international border to the mouth of the Snake River there is no place where there is a fall or head sufficient to generate any commercial power. The dam built on appellants' land creates a fall or head of 350 feet, which their engineer says is a little more than twice the head of Niagara Falls. The dam also creates a reservoir to store water upstream, which regulates the stream flow. Every foot of the fall or head is produced by the dam. The site on which the dam is built, the same expert says, becomes of primary importance and is indispensable to the development of the water power. The reservoir created behind the dam will increase the uniform flow of the Columbia River from 18,000 to 41,500 cubic feet per second.

The granite formation also extends across the river bed and upward to about 600 feet above the river on either side. No other place on the river has such characteristics.

It is also testified that it would not be practical to construct a dam anywhere else on the Columbia River which would serve the dual purpose of power and irrigation. It would be physically impossible to construct a dam on the Columbia River without using the lands which are being taken in this proceeding, "no matter how much money you wanted to spend."

Another engineer for the appellants says that private capital is always ready for a proposition of that kind which will show a profit, and that without the development of power at Grand Coulee there will be an actual shortage of power necessary to supply the area.

Another engineer said he had examined the Grand Coulee dam site; that he has probably never seen a dam site as good; and that it was entirely feasible and practical for private capital to acquire such lands, as a dam site in 1933, and utilize it for beneficial purposes and that there was a market for such lands.

Some of these witnesses on cross-examination stated they did not know why private capital did not purchase these lands and had not sufficient knowledge to answer the question as to why the property was not purchased in 1929. Others testified that there is no market for such dam-site purposes, and "that the discussion about the Grand Coulee project during recent years has been a discussion with reference to the attempt to get the Government interested in building that project and there never has been any private enterprise contemplated * * * in all that time for development of the project." There was no market for a dam site of such size at this location. Another witness testified that none of the lands had a market value for a dam site or reservoir in 1933.

Another engineer for appellants testified he was a graduate from Rensselaer Polytechnic Institute; had been employed by the Provincial Government of the Philippine Islands, by the New York State Barge Canal as a designer of dams and locks, and many other concerns and places, including the Beauharnois Development Co. in Canada, Connecticut River Power Co., Muscle Shoals steam plant water supply for the United States Government, and Arco nitrate plants at Alabama; likewise on the Los Angeles Flood Control District on the San Gabriel Dam, and to serve among others the New York Power & Light Co., North New York Utilities, Black River Irrigation District, Hudson River Irrigation District, Malone Light & Power Co., Soviet Government of Russia, Cities Service Co., and Niagara-Hudson Power Co.; that he has studied and reported on Niagara-Hudson Power Co.'s holdings on the St. Lawrence River; and that he had done work on such projects in 35 different States and a number of foreign countries, and knows the need and desirability of dam sites.

On cross-examination he said, "The St. Lawrence project which I referred to is close to Malone, Berhardt Island, St. Lawrence River. The population within a radius of 300 miles of that location is perhaps 10,000,000 to 15,000,000. I would assume that it would be more than 10 times as much as the population within 300 miles of Grand Coulee. The developments to which I refer as being somewhat near in size to this one are located in a territory where there is a very much larger population than is involved here. And then said, with relation to demands for sites: "I do not know of any large sales of dam-site property at that location or anywhere else in that vicinity at that time, or at any time near that date. There was some purchase of property by the Niagara-Hudson Power Co. for the St. Lawrence development during that period. Just exactly what dates I don't know. That is adjacent to a thickly populated country. I do not know of any such sales anywhere in the Northwest. No very large projects were constructed to my knowledge during the period of the depression. There were no hydroelectric developments started in the Northwest during the period between 1930 and 1934. There was no need for them at that time. During that time nobody would have financed such construction. Financing construction requiring $70,000,000 would be found very improbable. It would be foolish to construct a development where there was no necessity for power at that particular date, December 1933. My

recollection is that the court records indicate about 600 owners in the reservoir site whose property would have to be secured before the reservoir could be used. I do not know what kind of procedure you would have to go through to get the Indian lands which would be indispensable for that project, or the withdrawn lands that were withdrawn under Reclamation Act, or the State lands in the bed of the stream and the uplands. I do not know the total of that. I am not basing my testimony on my knowledge, but on the court records." And on redirect examination said, in response to the question: "Just a few moments ago you distinguished between financing the development of a power project at the Grand Coulee and purchasing the site which is involved in this lawsuit. Will you please explain a little to us why you made that distinction?"—

[Answer.] "My distinction is based on the knowledge that private companies are always on the lookout for dam sites to keep up with the market. Unless our economical structure is going to fall down flat the companies which are existing today to take care of the market and provide manufacturing power have just got to keep developing and supplying that market, and in order to do that they have got to look ahead and make plans and arrange for these dam sites. They have got to locate them and buy them. * * * "

He further said on re-cross examination: "I understand this dam site has been known for a great many years, at least 10 or 15 years. It was filed upon in 1922 by Colonel Cooper, but the filing was denied, which I understand was because of the desire of the United States Government to hold it for themselves. I don't know why the filer did not purchase the dam site at that time. I doubt very much if private capital would ever have built it in 1922. It is possible it might have acquired it in 1922. Why they did not, I don't know. The power market was growing much faster in 1929 than in 1933; 1929 was about the peak of growth. I do not know why private capital did not purchase it then, except that the previous effort to purchase it was denied on the ground that the Government wanted it. * * *"

The Columbia River is the second largest stream in the United States, larger than the St. Lawrence and surpassed in volume of flow only by the Mississippi. It carries more water than the combined flow of all the other streams of the Pacific slope. It is unique among all the streams of the West in that it is the only stream which has broken through the mountain barrier of the Cascade and Sierra Nevada Mountains and created a navigable channel from the interior to the Pacific Ocean. It has been used extensively for navigation purposes ever since the earliest settlement by the white man, and even prior to that time was used by the Indians as a highway for such trade and travel as was carried on by them.

The court will take judicial knowledge of the fact that the Columbia River is a navigable stream in fact as well as in law (*Arizona* v. *California*, 283 U: S. 423).

At the close of the trial the Government moved to strike from the record all testimony in regard to the market value of lands in question for dam-site purposes. The court, in granting the motion, said in part:

"In the State of Washington the beds of navigable streams are not vested absolutely or qualifiedly in the owners of the shore lands along such navigable streams. The bed of navigable streams in the State of Washington is vested in the State of Washington. The decisions of the Supreme Court of the United States are at one upon this proposition, that the Congress of the United States has absolute control over the navigable streams within the borders of the country. It has that power in virtue of the provisions of the Constitution of the United States which confers exclusively upon Congress the power to regulate commerce with foreign nations and among the several States and with Indian tribes. Navigable streams are great water highways, agencies, and instrumentalities of commerce, and the dominant power of Congress to control the waters of such stream is clearly settled and determined by repeated decisions of the Supreme Court of the United States. The decisions of the Supreme Court of the United States are to the effect that riparian owners of shore lands along the banks of a navigable stream do not have, as against the United States, any interest in or title to the waters which flow in the stream when the United States undertakes to develop it or to improve those water highways for the purpose of advancing and improving navigation. That the landowner so owning these adjoining shore lands is not entitled to have any allowance made to him based upon any title to the bed of the stream or any allowance made to him for any right that he has because of the water running in the navigable stream or its potential water power. * * *"

Again the court said:

"These owners, in my judgment, are not entitled to have that adaptability of this site taken into account for the reason they have neither title to the bed of the stream nor any right to the waters which flow in it as against the Government exercising dominant power to improve the stream for navigation purposes, and that they are not entitled to that because it has not been taken from them, and it hasn't been taken from them for the simple reason that they never owned it in the first place", to which ruling, exception was duly taken and allowed.

The appellants requested several instructions that the jury could consider evidence in fixing the value of the land, its adaptability for use as a dam site as well as all other uses to which the tract or parcel was adaptable. This request was denied and exception duly allowed.

The court fully and fairly instructed the jury upon every element to be considered in fixing just compensation to be awarded, which includes all elements of value that inhere in the property—not to exceed, however, the full, fair, cash market value of the property at the time of its taking, fairly and conscientiously arrived at, and not including the element of dam-site valuation. And the controlling time in this case is December 27, 1933, being the date when the properties in question were appropriated.

The appellants excepted for the reason that the law required the submission of such issue to the jury, and also excepted to the refusal of the court to give the requested instruction relative to the valuation of the property for dam-site purposes as the one statement of the law applicable to the case.

From the judgment upon the verdict this appeal is prosecuted.

The court could well rest affirmance upon the statement of Judge Webster in striking from the jury's consideration the evidence relating to dam-site value. The magnitude of this project and the legal issue involved are of such importance that we have at the risk of prolixity deemed it proper to give more of detail than is usual in the statement of the case.

Title to the river bed is in the State of Washington (art. 17, sec. 1, Constitution of Washington; sec. 7412 Revised Statutes of Washington).

U. S. v. *Chandler-Dunbar* (229 U. S. 53).

Shively v. *Bowlby* (151 U. S. 331).

Philadelphia Co. v. *Stimson* (223 U. S. 605).

Scott v. *Lattig* (227 U. S. 229).

As stated in the *Chandler-Dunbar* case, *supra*, title to the bed of the river in the shore owner is qualified, and, unless severed or excluded by implication, passed with it as a shadow follows a substance, and while it is helpful as against acts of third parties, is of no avail against the absolute power of the Congress to improve navigation. The Government has the power to cause the removal of obstructions in the river bed, and to forbid

the use of the river by the riparian owner which it believes injurious to navigation. It has the right to cut the riparian owner from direct access to deep water (*Scranton* v. *Wheeler*, 179 U. S. 141). The judgment of the Congress with relation to the navigability of the river and its development is conclusive (*Arizona* v. *California*, 283 U. S. 423; *U. S.* v. *Chandler-Dunbar*, *supra*). So much of the riparian or "fast" land taken as is private property must be paid for at the reasonable market value (*Chandler-Dunbar*, *supra*). The general question of valuation was fairly submitted to the jury. The riparian owner has no property right to the use of the water or the power inherent therein, or the fall and flow of the water for commercial purposes, or any purpose, as against the United States (*Chandler-Dunbar*, *supra*). That "ownership (of) * * * the running water in a great navigable stream is capable of private ownership is inconceivable" (*Chandler-Dunbar* v. *U. S.*, 229 U. S. 53 at 69).

To be continued in May issue

PATHFINDER IRRIGATION DISTRICT OFFICE, MITCHELL, NEBR.

The canal banks on this project are sandy and the inside slope must be covered with gravel to maintain the canal section. The bodies of the trucks are built wide so that the gravel is spread evenly over the canal bank as it is dumped from the truck and no spreading by hand is necessary.

A SUMMARY of the answers to the questionnaires used in the current slide lecture shows that soil building is uppermost in the farmer's mind.

CONSIDERABLE activity is reported in the sale of land on the Owyhee project, Oregon-Idaho, both new land and that lying within the old irrigation districts. Settlers are beginning to come in. Inquiries regarding project lands are being received by the Vale-Owyhee Land Settlement Association at the rate of 500 per month.

PLANS for the construction this spring of a $35,000 vegetable cannery at Ellensburg, Wash. (Yakima project), have been announced by a committee representing a group of Kittitas Valley growers. The committee also announces that sufficient stock has already been subscribed to assure construction and operation of the plant this season.

Community Rest Room

By Mrs. Evelyn Smith, Secretary Yuma County Chamber of Commerce

SOME 2 years ago, the idea of establishing a "community rest room" in Yuma for the women of the rural districts originated in the Roll-Wellton Women's Club.

Yuma, the county seat of Yuma County, is the central trading point for the large agricultural and mining section surrounding her. The area of Yuma County is 9,987 square miles. It is necessary for persons residing in the outlying districts to come to Yuma on shopping trips, for medical and dental attention, as well as other business. This, in many cases, calls for a drive of 100 miles or more for the round trip. Therefore, the idea of having a rest room, properly supervised, where women and children might rest while in Yuma, originated.

Their problem was taken to the home demonstration agent, who at that time was Mrs. Janet Copple, and she in turn consulted women of other outlying districts — Gadsden, Somerton, and the North and South Gila Valleys; also, the various women's organizations in Yuma.

A permanent rest-room committee, composed of representatives of the different communities, after investigating a similar project at El Centro, Calif., appeared before a chamber of commerce meeting and presented the matter. A chamber of commerce committee, composed of Messrs. A. O. Broussard, O. C. Johnson, and C. J. Killen, was appointed to work with the rest-room committee on plans for financing, operating, etc. The permanent rest-room committee is now composed of Mrs. Henrietta Morgan, of Yuma, chairman; Mrs. Wayne Wright, of Roll, secretary; Mrs. E. C. Cummings, of Gadsden; Mrs. Janet Copple, of Yuma; and O. C. Johnson, of Yuma.

It was agreed that a budget of $1,500 yearly would operate the room satisfactorily. Resolutions were prepared and presented to the county board of supervisors and the city council, and committees waited upon these leaders pointing out the necessity of such a project; and, this fiscal year budgets were set up by both the county and city for the maintenance of this room.

This community rest room opened Saturday, October 10, on Second Street—which is a central and convenient location. It is planned to have the room open on an 9-hour schedule—from 10 a. m. until 7 p. m. on Monday, Tuesday, Wednesday, Thursday, and Friday; and from 12 m. to 9 p. m. on Saturday. These, of course, are tentative hours, but if satisfactory will be continued.

The matron in charge of the room is a practical nurse and has had much experience in public work.

At the present time the project consists of one large room and a lavatory. As time goes on, the committee plans to divide the large room to have a small reception room where men can call for their wives and children; a lounging room where women can rest; and a small room with cots where the ill may lie down to rest.

The room is being furnished with money donated by the different clubs throughout the county, including the Yuma and Somerton American Legion auxiliaries. Lumber has been donated for tables and benches for children by C. J. Killen, and a stove for heating has been donated by O. C. Johnson.

Through the concerted effort of the city, county, and civic organizations, it is now possible for women to enjoy the shopping trip to Yuma.

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Central Valley

THE Central Valley project is designed to provide better distribution of water in the two great, semiarid, interior valleys of California. State and Federal agencies began studies in 1873 of methods of solving problems presented by unequal geographical distribution of rainfall in central California. The Central Valley project, outgrowth of these studies, provides an orderly development by which the waters of the Sacramento and San Joaquin Rivers will be conserved to fill two pressing and immediate needs and to serve additional beneficial purposes as well.

The primary purposes of this project are to provide a supplemental water supply for a large area in the southern end of the San Joaquin Valley, where an old and intensive agriculture is endangered by exhaustion of underground irrigation supplies; and to increase the low flow of the Sacramento River to prevent encroachment of salt water from San Francisco Bay upon the rich lands of the Sacramento-San Joaquin delta.

Storage of the huge surplus of the Sacramento River at Kennett Dam north of Redding is contemplated to regulate the flow of that fluctuating stream, and provide a reliable surplus for export to the San Joaquin Valley as well as to eliminate saline encroachment in the delta region. Regulation of the Sacramento also will improve navigation of the river, reduce its floods, and provide water for generation of hydroelectric power.

More than 400,000 acres of highly developed, settled, and producing lands in southern San Joaquin Valley now are dangerously short of water and are in the process of reverting to desert. In excess of 20,000 acres already have had to be abandoned.

A storage dam on the San Joaquin River at the Friant site near Fresno will provide these lands with the supplemental water supply needed. All the waters of the San Joaquin River already are being used by irrigators in its valley. That stored at Friant and diverted for use on the parching lands in the southern end of the valley must be replaced by substitution of water from the Sacramento River, the only source. Regulation of the flow of the Sacramento River will make water available for this purpose which will be diverted into the San Joaquin Valley through a delta cross channel and taken to improved lands in the central and northern sections of the San Joaquin Valley by the San Joaquin pumping system.

In excess of 400,000 acres of very rich lands in the delta are endangered by salt water encroachment. During periods of low flow in the Sacramento River, salt water penetrates the channels from which these lands are irrigated. Thousands of acres already have been ruined, and losses of varying degree occur every year.

Completion of the Central Valley project will correct both these situations.

Canals will extend from the Friant Reservoir south to the vicinity of Bakersfield and north to Madera, succoring the area where drought is continuous due to failing irrigation supplies. Another canal known as the Contra Costa conduit will also serve an irrigated area in the Walnut Creek-Concord area, carrying as well fresh water for domestic and industrial users on the south side of Suisun Bay where saline intrusion has caused great damage. The Contra Costa conduit will obtain its water from the supply made available in the delta by regulation of the Sacramento River.

On these pages are pictured scenes illustrating the problems which will be solved by the Central Valley project.

At the upper left is a view of the Sacramento River in flood. This variable stream wastes much of its precious water in annual spring torrents. This surplus water will be caught at Kennett Dam.

At the upper right is a view of the Kennett dam site on the Sacramento River a few miles north of Redding. Here a dam to impound at least 3,000,000 acre-feet of water, the principal engineering structure of the project, will be built.

In the middle at the left is seen a dead peach orchard with one lone tree, fortunate enough to obtain water from a neighboring farm, blooming. This orchard in southern San Joaquin Valley has been abandoned by its owner because his underground water supply is exhausted. It is returning to desert.

In the middle at the right is a flourishing orange grove in the southern San Joaquin Valley, the area threatened by lowering water tables. Four hundred thousand acres of lands such as these are in the process of reverting to desert as did the peach orchard.

At the bottom on the left is an asparagus field destroyed by salt intrusion in the rich delta region.

At the bottom on the right is a view of the agricultural lands in the Martinez-Walnut Creek area in Contra Costa County which will obtain supplemental water from the project.


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The Billion Dollar Engineer

By Edgar C. McMechen

SELDOM has a testimonial dinner been given to any man that has held so much interest and significance as that given in Denver, February 8, to John Lucian Savage, Chief Designing Engineer of the United States Bureau of Reclamation.

The occasion was the presentation of Colorado Engineering Council's gold medal award for distinguished service in the engineering field. In the day's news, featured by war and rumors of war, by strikes and floods and economic crises, the event did not loom large. But in the technical and scientific world the presentation was one of great importance.

Perhaps the most understandable way to make a popular appraisal of his work would be to call Jack "Dam" Savage the first Billion Dollar Engineer, because the irrigation and power structures designed by him will not fall far short of that valuation.

Since he identified himself permanently with the Reclamation Service 20 years ago he has designed 55 major dams, which have cost or will have cost when all are completed, $627,470,000. In the same period of time he has designed canals and structures on irrigation projects that increase this figure by $119,207,000. Here alone is three-fourths of a billion dollars, and this does not represent the total output of this engineering genius. Chief among his accomplishments is the $130,000,000 Boulder Dam and power plant, yet the $180,000,000 Grand Coulee Dam and power plant on the Columbia River, now 25 percent completed, will eclipse this. To plan monolithic structures such as these, with their multiple technical problems never before encountered, truly calls for Archimedean imagination.

The technical world, however, will not measure Mr. Savage's work in dollars, because its result upon generations to come is incalculable.

The presentation of council's award was attended by more than 300 members of constituent organizations, including Colorado sections of the American Institute of Mining and Metalurgical Engineers, American Chemical Society, American Society of Mechanical Engineers, American Society of Civil Engineer, Rocky Mountain sections of the Society of American Foresters, American Water Works Association, Association of Petroleum Geologists, Colorado Society of Engineers, Colorado Scientific Society, Colorado Chapter American Institute of Architects, Engineers' Club of Fort Collins, Pueblo Engineers Society, and Teknik Club. Mr. Frank H. Prouty, president of the Colorado Engineering Council, presided and introduced Mayor

JOHN LUCIAN SAVAGE.

Benjamin F. Stapleton of Denver and Governor Teller Ammons of Colorado, who made appropriate remarks. Dr. William Frederick Durand, distinguished engineer-professor of Stanford University and former president of the American Society of Mechanical Engineers, gave unstinted praise to Mr. Savage. There followed a series of appropriate talks upon the various phases of Mr. Savage's

work and accomplishments delivered by his associates and coworkers in the Reclamation Service, from which most of the information in this article is drawn or quoted direct.

TESTIMONIALS OF ASSOCIATES

Those who took part in this symposium were: Raymond F. Walter, Chief Engineer of the Reclamation Bureau, who gave an Appreciation by an Associate; Sinclair O. Harper, Assistant Chief Engineer, who spoke on Large Projects Designed Under Supervision of Mr. Savage and Their Value Expressed in Dollars; William H. Nalder, Assistant Chief Designing Engineer, who talked on Unusual Application of Engineering Principles; Leslie N. McClellan, Chief Electrical Engineer, on Accomplishments Told Electrically; Erdman B. Debler, Hydraulic Engineer, on Life History of Mr. Savage; Henry R. McBirney, Senior Engineer, Canals, on His Hobby; and Kenneth B. Keener, Senior Engineer, Dams, on Anecdotes. Acknowledgments from the engineering and scientific organizations were given respectively by Fred G. Carstarphen and J. Claire Evans.

John Lucian Savage was born on a Wisconsin farm near Cooksville on Christmas Day, 1879. His father was a successful farmer, his mother a gifted writer. His engineering bent apparently was derived from his grandfather, a prominent surveyor when that was the mainstay of civil engineering.

He first attended private school for 2 years at Spring Green, Wis., where he was the only Latin scholar. One year in the Evansville high school and 2 at Madison were followed by 4 years at the University of Wisconsin, where he was admitted to Tau Beta Pi honorary fraternity in his junior year. He was a member of the Badger Annual staff. In this publication he was classified by the quotation "Women are not of his sphere." In 1903, fortified by three summers of experience with the Wisconsin and United States Geological Surveys and his B. S. degree, Mr. Savage left Wisconsin for field work on the Minidoka project.

Of this period Mr. Debler said: "Idaho's greeting was an unseasonable snow, and his first sight of headquarters a tent with a yellow smallpox flag in the sagebrush plain. The next winter and the four following years were spent in the Boise office of the Reclamation Service, largely on the design of irrigation structures under the general guidance of Arthur P. Davis, then chief engineer, but more especially by D. W. Ross and A. J. Wiley, both of whom have now passed away. With so many traits in common it was but natural that in 1908 Mr. Savage should leave the Reclamation Service "to become associated with Mr. Wiley in an engineering practice boomed by a water-utilization program by private interests in the irrigation and power fields. Both were, however, retained by

the Service in a consulting capacity, Mr. Wiley to his death and Mr. Savage until he joined the Service in 1916."

During the period of his association with Mr. Wiley, Mr. Savage participated in, and in most instances designed, many important structural works. The Salmon River Dam, the Swan Falls power plant on Snake River, the Barber power plant on Boise River, the Oakley Reservoir Dam and the American Falls power plant were outstanding works. During this time he received special assignment from the Reclamation Bureau for design of gates in the Arrowrock Dam, Boise project.

Several interesting facts come to light at this point. First, Jack Savage from the first was a prodigious worker, a habit that has lasted to the present time. Fourteen hours a day and generally week ends constituted his usual assignment. His early associates recall that, although "he was the worst cook and the poorest pistol shot in the world", he was also first out in the morning and the last to leave work at night.

CLOSE APPLICATION TO DUTY

While in Idaho, his only business interests outside engineering took place. He owned a farm or two and developed a fine herd of beef cattle that he enjoyed "looking at Sunday afternoons."

It is no matter of surprise that his rise in the Reclamation Service was so phenomenal under such conditions. This is one Government service, at least, where seniority does not hold back a talented man. Knowledge and application advance a man automatically here. Getting in on the ground floor, Jack Savage materially aided in formulation of the principles upon which the Reclamation Service always had been conducted.

In 1916 Mr. Savage reentered the Reclamation Service in charge of civil designing work in the newly organized office of the Chief Engineer at Denver, Colo., where all important designing work was then concentrated. In 1924 he was placed in responsible charge of all important designing for the Bureau with the title Chief Designing Engineer.

The return to the Reclamation Service in 1916 gives an excellent key to Mr. Savage's interests and inclinations. His association with Mr. Wiley had been lucrative and there is little doubt that had he so desired he might have continued as an independent engineer and amassed a large fortune. There are several elements that always have loomed large in his scheme of life. The making of money has not been one of these. Mr. Savage always has manifested a desire to serve the public interests and to take part in enterprises that have as their objective the development of human relations. Then, too, he always has preferred close association in work with men of technical and scientific attainments, men who like scholarly research. This interest in life, a decided freedom from routine methods, has reflected in the creative application of engineering principles to the problems he has had to solve.

Since his return to the Service in 1916, the volume of work turned out by Mr. Savage has been stupendous. Mr. Harper, Assistant Chief Engineer of the Reclamation Bureau, has thus summarized his accomplishments:

"Heading the list in appeal to the imagination is, of course, the Boulder Dam and power plant, now complete except for the installation of the remaining power units. This structure, however, will soon be eclipsed by the Grand Coulee Dam and power plant on the Columbia River, now about 25 percent complete.

"Other major dams designed by Mr. Savage, which have been completed, are under construction, or have been approved for construction, are: Kennett Dam and power plant, $112,000,000; Norris Dam and power plant, $36,000,000; Wheeler Dam and power plant, $32,000,000; Friant Dam, $15,500,000; Madden Dam and power plant, $12,500,000; Marshall Ford Dam, $11,000,000; Imperial Dam, $8,600,000; Parker Dam, $7,700,000, American Falls Dam, $7,300,000, Owyhee Dam, $6,700,000, Seminoe Dam and power plant, $5,900,000; Hamilton Dam, $5,000,000.

"In addition to these 14 monumental structures Mr. Savage has designed 11 dams ranging in cost from $2,000,000 to $5,000,000, the total cost of which is $32,400,000; 12 dams ranging from $1,000,000 to $2,000,000, costing a total of $16,930,000; and 18 dams costing less than $1,000,000 each, and totaling $7,940,000. The total cost, actual and estimated, of these 55 major dams is $627,470,000. This figure does not include numerous small diversion dams constructed in connection with the canal system.

CANALS ALSO DESIGNED BY MR. SAVAGE

"In addition to the dams which Mr. Savage has designed he has also supervised the designing of hundreds of canals and thousands of structures on irrigation projects constructed by the Bureau during the past 20 years, ranging from the $38,000,000 All-American Canal, the largest ever constructed in this country, down to the smallest lateral structures costing a few dollars each. The total cost of such works designed under his direction, exclusive of dams, has amounted to $119,207,000, bringing the grand total of all works designed by Mr. Savage since he has occupied his present position to $746,677,000.

"While I have no method of verifying this statement, I think I am safe in saying that no engineer in the history of this country, or even of the world, has a record of accomplishment which can equal this. But these cost figures—impressive as they may be—represent only a small part of the economic value of these projects in the future development of our country. Such values can only be estimated in billions of dollars."

W. H. Nalder, assistant to Mr. Savage, has this to say of his chief's ability to make new and unusual application of fundamental engineering principles:

"There is the trail-load method of arch dam analysis. The inconsistencies that were known to exist between the actual measured stresses and deflections in constructed dams, and the values computed by all former methods of analyses gave rise to its development in order that such structures as Gibson, Owyhee, and Boulder Dams might be safely and economically designed. The method is roughly divided into three parts: A radial adjustment which solves the resistance of the structure against movement in a radial direction, or toward the center of curvature; a tangential shear adjustment which evaluates the resistance of the various elements against movement in a tangential direction; and a twist adjustment which determines the resistance to rotation in the mass of the dam. The complexity of this type of study is obvious.

"The results have been very gratifying, and the old inconsistencies between theory and fact have disappeared. The development of this method of arch dam analysis in its entirety, together with related studies and the splendid verification of its accuracy by model testing and the measurement of the actual deflections and stresses in the finished structure under load, form a remarkable record of achievement in engineering design.

"Then there is the artificial cooling of mass concrete. The construction of Boulder Dam, with the necessity of producing a monolithic and crack-free mass of concrete of its enormous dimensions, in a construction period of 2 years, necessitated the development of a practical method of artificially cooling the concrete to remove the setting heat and accomplish the same amount of cooling shrinkage of the mass, without cracks, in a few months' time that otherwise would have taken over 100 years. This was done by the novel method of providing both radial and circumferential contraction joints, and circulating natural and

artificially cooled water through pipes embedded at accurately predetermined intervals throughout the concrete mass. The researches and studies entailed in developing and controlling the thermal, elastic, and volume-change properties of cement and concrete is another notable record of engineering accomplishment. The final results in the Boulder Dam have verified with remarkable accuracy those that were predicted, and this method now is in general use in mass concrete construction where volume change must be controlled. Closely associated with the foregoing, there was carried on the development and perfection of new and improved methods of pressure grouting contraction joints, and the development of special cements with favorable thermal properties."

To sum up the regard in which Mr. Savage is held by his associates the words of Chief Engineer Raymond F. Walter reflect that spirit:

"Mr. Savage is a man of many friends and acquaintances in the engineering profession, where his technical and practical knowledge of design and construction of large dams is especially recognized, and today, I believe, he is the most outstanding and widely known authority on high dams in the United States if not in the world."

To mention a few of the unique conditions that Mr. Savage has encountered and solved: The Kittas division main canal includes a river crossing rivaling the Hudson River crossings of the New York City water supply, but of much larger capacity; the Gooding division canal passes through 75 miles of recent lava fields; the All-American Canal passes through many miles of drifting sandhills and crosses numerous cloudburst washes. The needle-valve design on the Boulder Dam project has attracted widespread attention also.

MR. SAVAGE AS CONSULTANT

Numerous consulting engagements might be mentioned, the more important in recent years having been for T. V. A. (other than those designed by the Bureau of Reclamation) on Tennessee River dams; for the city of San Francisco in raising the Hetch-Hetchy Dam; for several dams near Los Angeles; for the Crow Creek Dam near Cheyenne, Wyo.; for the Puerto Rican Government on the Isabella project; for the West Indies Finance Corporation on the Barahona project; and for the United States International Boundary Commission on Rio Grande dams and channel rectifications below Elephant Butte.

Despite his enormous duties, Mr. Savage has maintained a surprising personal contact with construction, often going out of his way to help contractors or construction engineers in their problems.

Service has been his watchword, and it has not always been in the line of duty. It is characteristic that his principal hobby in life has been to assist worthy young people to obtain university training. Nephews, nieces, even distant cousins have lived at his home, at times two or three staying there while completing college courses that he has made available to them. Seven have been boys, four have been girls. They all are deeply devoted to him, attracted by his kindly nature, his even temperament, his keen sense of humor, and ready response to those who have a serious purpose in life. His social activities are almost nil, aside from a small but congenial circle of friends. His wife, whom he married in 1918, has been deeply sympathetic with his plans and has been a great help to him.

Mr. Savage has frequently been honored for his work, although he has never sought recognition. He has served on several special committees of the American Society of Civil Engineers, is a member of several honorary fraternities, and has received the degree of Doctor of Science from Wisconsin University.

Excerpts From February Project Reports

Yuma.—Picking of the 1936 cotton crop was completed during the month; 107 bales were ginned, of which 13 were from the Gila Valley. Total ginnings for the season were 12,114 bales, of which 700 were from the Gila Valley, the balance representing Yuma project production.

Yuma auxiliary.—Picking of the season's grapefruit proceeded slowly throughout the month, pending developments relative to the extent of the damage from the January cold weather with the result that at the close of February only approximately 37 percent of the crop was harvested. The apparent loss from the cold temperatures was estimated at 20 to 30 percent of the total crop. The new growth on the trees has already started to replace the defoliation from the freezing weather, and apparently will develop heavy blossoms. This prediction is based on past experience after the trees have gone through low temperatures. There was a firm demand for citrus because of the shortage of fruit elsewhere for the Pacific Coast markets, and fruit which normally would be rejected may now be packed and sold at remunerative prices. Fruit was sold considerably higher than the previous month.

Klamath.—About 450 cars of potatoes were shipped from the project during the month, bringing the total shipments to date to 5,350 cars. It is estimated that about 1,650 cars still remain in storage on the project. Indications are that there will be about a 10-percent increase in the acreage planted to potatoes, and that the total acreage planted will be approximately 18,500 acres. Although snows and cold weather during February made heavy feeding necessary, all livestock is in good condition.

Yakima.—Markets continued to be very satisfactory throughout the month, with little change in crop prices. No. 1 alfalfa hay, baled, increased from $12.50 a ton at the first of the month to $15.50 a ton at the close. The price of rutabagas and onions continued to rise, some of the former crop being exported to the Orient.

Humboldt.—All crops produced in the 1936 season have been sold at satisfactory prices and there will be no carry-over.

Milk River.—A very decided advance in the hay price occurred during the month, but practically none remains for sale. A few sales were made at prices ranging from $15 to $17 per ton in the stack, and baled hay is being shipped into the project at around $20 per ton. Commercial potatoes are being sold at $2.25 to $2.50 per hundredweight and seed potatoes command a price of approximately $3.25 per hundredweight. The livestock market continued favorable, especially upon stock fattened for the market.

CONGDON and Battles of Yakima recently shipped to Warrenton, Va., ten Aberdeen-Angus cattle. This shipment consisted of nine choice heifers and Epponian VIII of Rosemere, grand champion bull. The cattle were exhibited at the Chicago International Exposition.

A 40-ACRE well-improved farm northeast of Rupert on the Minidoka project, Idaho, was recently sold for $7,000, and another 40-acre tract adjacent to Paul, on the same project, also was disposed of at $3,300 cash.

Progress of Investigations of Projects

Blue River transmountain, Colorado.—Points were established for horizontal and vertical control along the canal line from Watertown toward Sedalia and Watkins. Topography was taken on the canal line from Clear Creek to South Platte. Area and capacity tables of Dillon Reservoir site on the Blue River at Dillon, were completed, horizontal control was plotted, and descriptions of triangulation stations were written.

Colorado-Big Thompson, transmountain diversion, Colorado.—Final report is in course of preparation. A review was made of previously estimated discharges, and records of daily stream flows were extended to cover winter months. Hydrographs are now in the course of preparation showing the daily discharges of the Colorado River at Glenwood Springs and Palisades and the effects thereon of Granby Reservoir and Green Mountain Reservoir operations.

Eastern slope, Colorado. (*a*) *Cherry Creek surveys.*—Located east of Castle Rock, Colo. Topographic surveys were completed at the dam site above the Castlewood Dam. A similar survey is now under way at the old washed-out Castlewood dam site and the stream bed for approximately 1 mile below.

(*b*) *Trinidad irrigation and flood control.*—Located about 7 miles southwest of Trinidad. Topographic surveys were continued on the reservoir site on the Purgatoire River and its side canyons.

(c) *Hugo irrigation and flood control.*—Located on Big Sandy Creek about 5 miles southeast of Limon. Topographic surveys were completed on the lower reservoir site, and are now in progress on the connecting canal between the upper and lower sites.

(d) *North Republican River.*—Located about 9 miles southwest of Wray. Area and capacity curves were computed from the information obtained by topographic surveys of the reservoir site.

(e) *Arickaree River.*—A preliminary line was run, and cross sections taken along the river, beginning about 7 miles northwest of Idalia, Colo., and continuing approximately 7 miles upstream.

(f) *South Republican River.*—Survey lines were run and cross sections were taken at the following locations: *Farr Site* located about 4 miles east of Flagler, *Flager Site* located about 5 miles south of Flagler, *Spring Creek Site* located about 8 miles south of Vona.

Western slope, Colorado.—(a) *La Plata project.*—Test pit work at Upper Hay Gulch Dam site was completed, and a report on the geological conditions prepared.

(b) *Mancos Valley projects.*—Test pit work at Jackson Gulch Dam site was completed, and a report, covering geological conditions at the dam site, prepared.

(c) *Paonia project.*—Tabulations and field estimates on land classification were completed, and prepared.

(d) *Roan Creek project.*—Maps, crop census, and land classification data were completed in the field.

(e) *Silt project.*—Field mapping and the report of irrigable acreage, crop census, and water rights were completed.

(f) *West Divide Creek project.*—Report on land classification, crop census, water right data, and maps of Haystack, Owens Creek reservoirs, and Buzzard Canal were completed.

(g) *Yampa reservoirs.*—Report is in course of preparation.

Rio Grande Basin, Colorado-New Mexico.—(a) *Conejos Dam site.*—The water supply studies of the Conejos Reservoirs were continued. Hole No. 1 at the Mogote site was drilled to a depth of 250 feet, through silts and gravels. A preliminary design and estimate was completed for the dam at the Upper Conejos site, and work was begun on the design for the Lower Conejos site.

(b) *San Juan-Chama diversion.*—Studies were made to determine the amount of terminal storage required to equalize the flow from the diversion canal of the project to fit the demand of lands in the Middle Rio Grande Valley. Two test-pit crews have been at work on the Stinking Lake site all month. Preliminary designs and estimates have been completed for the dams at the West Fork-San Juan, East Fork-San Juan, Blanco, Navajo, Stinking Lake, and Boulder Lake sites.

(c) *State line dam site.*—Drilling was continued throughout the month. Holes drilled on the upper site disclosed ground water 66 feet below the river bed. At the Ute Mountain site, 11 miles below the State line, ground water was known to be at river levels, and a hole drilled in the river bottom, showed basalt rock to a depth of 200 feet under an 8-foot gravel overburden.

Boise (Boise-Weiser-Payette), Idaho.—Topography was continued along the canal lines from Banks toward Horseshoe Bend, and between Boise Diversion Dam and Dry Creek. Three parties spent all or part of the month establishing vertical control, taking topography, and classifying land in the Mountain Home area. Data for water-supply studies are being assembled.

Gallatin Valley, Mont.—During the month, data were compiled for the Spanish Creek Reservoir, and a report is in preparation.

Buffalo Rapids, Mont.—The "Supplemental Report on Mid-Yellowstone (Buffalo Rapids) Irrigation Project, Montana", was completed and distributed to interested parties.

Saco Divide, Mont.—Report on these investigations is nearly completed. The estimates include costs of pumping by both natural gas and electricity.

Conchas project, New Mexico.—The Conchas Main Canal traverse was continued, some topography taken at critical points, and land classification surveys were near completion. A preliminary water supply study was made. Estimates of the river discharge at the dam site from 1904 to date were assembled.

Deschutes, Oreg.—Report of the Plainview project was under preparation. Drawings, and the plan and estimate of the Suttle Lake Dam and Reservoir, are almost completed. The text of the South Unit report was completed. Report on Waldo Lake diversion is nearly completed.

Black Hills, S. Dak. (a) *Angostura project.*—Preliminary studies of required spillway capacity and available water supply were completed during the month, and report was under preparation.

(b) *Rapid City project.*—The cost estimate for the railroad relocation at the Pactola Reservoir site on Rapid Creek was completed. Preliminary operation studies of the Pactola Reservoir were made.

Utah investigations.—The report covering the 1936 investigations of the Dixie project was about completed. Data were being assembled on the canals in connection with the preparation of a report covering the Blue Bench investigations. Preliminary plans for the Salt Lake Metropolitan Water District aqueduct were completed, and data are being assembled for inclusion in reports on Currant Creek, Ouray, and Gooseberry investigations.

Colorado River Basin.—Due to weather conditions, the field work was confined to undeveloped lands in the vicinity of Thompson, Cisco, and Green River, Utah. Control and preliminary mapping were done on about 104,000 acres, and approximately 77,000 acres were classified.

THE RESETTLEMENT Administration has erected two general warehouses and is considering the erection of a potato warehouse on the Sun River project, Montana.

Summer Program of Reclamation C. C. C. Camps

By Alfred R. Golzé, Supervising Engineer, E. C. W.

EARLY in March of this year the Director of Emergency Conservation Work approved the program of C. C. C. camps to be operated by the Bureau of Reclamation during the Ninth C. C. C. Enrollment Period—April 1 through September 30, 1937, subject to legislative action by Congress for operation of the Civilian Conservation Corps after July 1, 1937.

PROGRAM OF CAMPS

The program, approved by the Director, E. C. W., provides for the continuation without change of 31 camps in operation during the past winter, the suspension of 3 camps, and the reoccupation of 3 others—maintaining the total number of 34 camps that have been operated by this Bureau since January 1936. The distribution of C. C. C. camps by projects for the summer of 1937 will be as follows:

Project:	*Camp no.*
Belle Fourche	BR-2.
Boise	BR-24.
——Boise	BR-26.
Carlsbad	BR-3.
Grand Valley	BR-22.
Grand Valley	BR-59.
Humboldt	BR-36.
Huntley	BR-57.
Klamath	BR-20.
Klamath	BR-41.
Lower Yellowstone	BR-30.
Milk River	BR-32.
Minidoka	BR-27.
Moon Lake	BR-11.
Newlands	BR-34.
Newlands	BR-35.
North Platte	BR-1.
North Platte	BR-9.
North Platte	BR-53.
Ogden River	BR-12.
Owyhee	BR-42.
Owyhee	BR-43.
Rio Grande	BR-4.
Rio Grande	BR-8.
Rio Grande	BR-39.
Rio Grande	BR-54.
Salt River	BR-19.
Shoshone	BR-7.
Sun River	BR-33.
Truckee River Storage	BR-37.
Umatilla	BR-44.
Uncompahgre	BR-23.
Vale	BR-45.
Yakima	BR-49.

Construction of new C. C. C. camps has been restricted since the end of August 1935 when a policy of reducing the strength of the Civilian Conservation Corps was adopted. In the year and a half interim there has been a gradual reduction in the total number of camps in operation, from approximately 2,500 to 2,000 occupied today. This reduction has been accomplished chiefly by closing camps as they finished the work planned for them. However, the number of C. C. C. camps assigned to the Bureau of Reclamation has been held at 34 or 1.7 percent of the present total.

Although the C. C. C. was created in the spring of 1933 and a few camps were assigned to the Bureau of Reclamation in 1934, it was not until the fall of 1935 that a conservation program on reclamation projects, utilizing the services of the C. C. C. camps, was commenced on a large scale. The subsequent brief period of a year and a half has only been sufficient to complete part of the most important and urgent work with a large amount remaining to be done over a period of years, and for this reason no camps on the reclamation projects have been permanently closed.

A TYPICAL CCC MESS HALL.

WORK OF ENROLLEES

Three and one-half million acres of irrigated lands, along with their irrigation water-storage reservoirs, thousands of miles of canals, and innumerable water-control structures represent the primary real interest of the Government in western reclamation. The work of the C. C. C. enrollees is being directed to the features of work which will enhance the security of the investment of the United States in those projects and tend to assure the return of money advanced by the Government for reclamation and associated developments. These features include, principally, the construction of earth dams, the restoration and improvement of canals, by clearing, cleaning, concrete lining and riprapping, the reconstruction of canal structures, erosion control on rivers and contributing watersheds and improvements to storage-reservoir areas.

Studies have been made which indicate the desirability of extending the conservation activities of the C. C. C. camps to those reclamation projects in need of rehabilitation and to which it has not been possible to assign a camp because of the limitations previously mentioned. There is also a need, in a few cases, of increasing the number of camps on projects which now have them, to more rapidly complete the needed improvements. The future policy of the C. C. C. which remains to be announced, will determine in a large degree whether this objective can be obtained.

Legislation and appropriations, now existing, provide for the continuation of Emergency Conservation Work and the C. C. C. camps only until June 30, 1937. Although Congress may enact legislation to continue this work on a more permanent basis beginning July 1 next, no definite information is available as to what form that legislation will take, or the effect it will have on the operation of C. C. C. camps by this Bureau.

Reclamation Progress on the Vale Project, Oregon

By Henry L. Lumpee, Assistant Clerk

IN OREGON in 1936 on the Vale project of the Bureau of Reclamation, 4,410 acres of land never before disturbed by the activity of agricultural production were cleared, planted, and given to the raising of irrigated crops.

On these acres, comprising 56 separate farms, 324 persons made their homes the past year, their new houses, fences, and fields occupying land which in 1935 had been an expanse of unproductive sagebrush.

These important additions to the project increased the number of irrigated farms within its boundaries from 217 to 273, its irrigated area from 6,994 acres to 11,404, and its farm population from 876 to 1,200, all within a year's time.

Also, partly as a result of this growth and partly because of improved growing conditions on the older sections of the project, coupled with better prices for farm products generally, the value of all crops produced increased from $136,046 in 1935 to $253,829 in 1936. As in the past, alfalfa hay continued to occupy the greatest number of acres given to the production of any one crop, 5,033 acres being used for this purpose in 1936, as against 3,873 in 1935.

The worth of the project's livestock also showed a gain of $60,500 or approximately 56 percent. This does not include 2,250 range cattle and 23,000 range sheep worth $317,500 being wintered on the project, nor 2,216 turkeys valued at $3,952. Dairy cattle led this advance, the count rising from 829 head worth $32,400 in 1935 to 1,474 head worth $58,875 in 1936.

The value of farm equipment, including motor vehicles, increased from $67,288 to $99,217 during the year.

The best money crop produced in 1936 was crested wheat seed, of which 8,000 pounds harvested by one settler from 9 acres had a value of $4,000. A second settler planted 42 acres to white potatoes, and harvested from them 12,600 bushels worth $15,120.

The total value of the crops this farmer raised on 119 irrigated acres was $17,187, the largest showing on the project during the year.

The growth of the project in 1936 had a stimulating effect upon adjacent towns. The city of Vale, county seat of Malheur County, located near the center of the project, increased in population from 1,000 to 1,200. A reclamation census shows that Harper, trading center for the completed westernmost section of the project, had 150 inhabitants in 1935 and 200 in 1936. North of Vale on the project's Willow Creek unit, where construction of the lateral system is still under way and colonization is just beginning in full force, the town of Jamieson increased its population from 50 to 100 in a year's time.

At Vale several new business firms were founded during 1936, and a handsome new union high school building was erected. More automobiles and pedestrians were seen on the streets, more buyers in the stores, and business generally was better than the previous year. Deposits in the Bank of Malheur, located at Vale, increased from $323,000 in 1935 to $400,000 in 1936, with a gain in the number of depositors of 350.

Further growth of the above towns is probable as settlement of the project continues.

It is expected that construction of the Willow Creek unit lateral system, designed to irrigate 15,000 acres, will be completed during 1937. When this work is accomplished the irrigation of all the 30,000 acres comprising the present area of the project will be possible. From present indications settlement of the Willow Creek unit will be rapid, and with this in mind, it would seem that 1937 should be a banner year for turning sagebrush into farms on the Vale project, with consequent good to the county, the State, and the Nation as a whole.

Resettlement Activities on Grand Valley Project

The Resettlement Administration reports progress on 28 new homes on their project under the private and Government canals of the Grand Valley project, Colorado, in the lower valley. These dwellings are being built according to one set of specifications, are modern in every respect, and are all wired for electricity. The project covers roughly an area 12 miles long and 6 miles wide, north of the Colorado River. This project has furnished work during the winter months to approximately 170 men, the pay roll amounting to about $14,000 per month.

The plan is to move Colorado families from the eastern slope dust bowl areas to these units. It is expected that most of the buildings will be ready for occupancy in April.

A LARGE number of inquiries are being received on the Shoshone project in regard to homestead opportunities. These inquirers are being referred to other projects or to the project water users who have listed their farms for sale. It appears that all good agricultural land on the project will be farmed this season, and the demand for land is great. There are few farms for sale or rent.

Yuma Students Travel Far for Education

By Val Reese, Student of Y. U. H. S.

BREAKING the profound stillness of early morning, a large yellow bus purrs through the desert. It is loaded with a noisy, laughing cargo of students gathered from the rich valley behind. Now the bus steadily clips off the miles of desolate land of sagebrush and shifting sand. Soon the vehicle begins a tortuous, twisting, turning way over jagged mountains, and, descending, covers another span of desert. Approaching a city located on the banks of the murky Colorado River, it stops in front of a group of modern school buildings, where other busses with similar cargoes from similar sections are drawing up. And the school day for desert dwellers has begun.

This procedure is followed every day in carrying out the system of transportation which has been developed for the Union High School of Yuma, Ariz. Nineteen hundred and seventy-two square miles are embraced by this unique transportation system. The reason that such a large area is covered is that the population in this corner of Arizona is concentrated in rich river valleys between vast areas of uninhabited desert.

And so the problem of education, and the even more serious problem of collecting students from the isolated districts, has been solved in the remotest corner of America's last frontier.

Y. U. H. S. SERVES WIDE TERRITORY

Easterners would doubtless have trouble visualizing the large territory that is served by the Yuma Union High School. But perhaps an illustration of the following order would serve as a basis for comparison: If the 1972 square miles of western country were placed in New York City with only one high school for secondary education, this building would have to assume the dimensions of the Empire State building and the Woolworth Building combined to make accommodations for the enrollment, set theoretically at 136,000 students.

Students of the Union High School of the Yuma district probably travel more miles for an education than any other combined student body in the United States. The 733 regularly enrolled students travel 8,493 miles daily, or during the school term a distance equal to 61 times around the world. The students travel more as a whole in 1 day than Columbus did on his 3-month voyage to the New World.

Not many years ago students threw saddles on their horses and rode to school cowboy fashion. Those who resided in Somerton, which is now only a few minutes drive on pavement, had to move to Yuma during the school year. In the past the student would cast an apprehensive glance toward the sky and say, "Mom, guess I can't go to school today, looks like it's going to kick up a sandstorm", or "It's too hot for my horse to travel." Ho, hum! Now students merely close bus windows to keep out the stinging sand, or open windows when it is hot.

The first bus at Yuma High School was acquired in 1918, and from that time on additional ones have been purchased. In the past 2 years a new fleet of eight modern buses has replaced the accumulation of older vehicles.

COST OF TRANSPORTATION

Both California and Arizona are served by the Yuma High School system. The total number of students from California is 123, or 16.5 percent of the entire student body of 733 members. The city of Yuma itself contributes but 347 students, or 47.34 percent, which leaves the larger percentage of 52.66, or 386, to come in from surrounding territory. Two students journey from San Luis, border town between Mexico and Arizona. Transportation of all students constitutes a serious financial problem which is being met adequately. Cost for this service in the school year of 1935–36 was $14,281.66, including purchase of several buses. This does not include cost of transportation from California, which is paid for by that State. The 8 buses, it has been pointed out, travel 102,960 miles in 1 year.

Routes of the buses run from Yuma through Yuma Valley in the extreme western, central, and eastern routes to Gadsden, 21 miles distant. One bus continues to San Luis, 28 miles from Yuma. Another route runs along U. S. Highway 80 from Yuma, over Telegraph Pass to Wellton, 34 miles away. Private transportation continues from Wellton to Roll, 49 miles from Yuma. Routes in California lead to Andrade, 9; Winterhaven, 3; Bard, 12; and Imperial Dam, 27. Private transportation extends to Ogilby, a gold-mining town, 15 miles away.

Raymond Erwin, senior, who lives out Roll way, travels 98 miles daily or farther than across the State of New Jersey, and when he was asked how he enjoyed his miles of riding before and after school for his education, replied: "Oh, the trip is O. K. but getting up so early and the continual blowing of the horn to keep the coyotes off the road isn't so hot."

Public Land Opening Owyhee Project, Oregon-Idaho

The Secretary of the Interior has announced the opening to entry on April 15 of 33 public land farm units on the Dead Ox Flat and Mitchell Butte divisions of the Owyhee Project, Oregon-Idaho.

For a period of 90 days from the date of opening ex-service men will be eligible to apply for units. At the expiration of that period the remaining units will be open to the general public. Each applicant, including ex-service men, must have a capital of at least $2,000 in cash or its equivalent in farm implements, livestock, etc., deemed by the examining board to be as useful to the settler as cash. He must also have had at least 2 years' farming experience, preferably on irrigated land, his industry and character must be vouched for, and he must be in good health.

Requests for literature, including farm application blanks, should be addressed to the Commissioner, Bureau of Reclamation, Washington, D. C., or to the Construction Engineer, Bureau of Reclamation, Boise, Idaho.

TWENTY new residences on the Orland project are under construction for the clients of the Resettlement Administration, and although not elaborate, the houses are well planned and should prove satisfactory.

Erratum

In the March issue of the Era at the top of page 47, the caption of the picture given as "Vallecito Dam, Pine River Project, Colorado, etc." should have been "Pine View Dam, Ogden River Project, Utah. Snow condition at inlet portal of Eden Tunnel. Operating bridge at right."

A HEALTHY growth in the demand for farm properties on the Orland project, California, is noticeable, and in the majority of cases those seeking land are already water users who have small holdings in the project. Real-estate dealers report increased interest and several sales have been made.

Articles on Irrigation and Related Subjects

All-American Canal:

All-American Canal progress, illus., Eng. News-Record, Feb. 18, 1937, vol. 118, no. 7, pp. 258–261.

Buchanan, Hon. Jas. P.:

Remarks on death by Hon. Wright Patman and naming of Buchanan Dam in Texas, Cong. Record, March 4, 1937, vol. 81, No. 44, pp. 2400–1.

Cement:

Portland, Moderate—heat of—hardening. Federal Specifications SS–C–206, Sept. 30, 1936, 4 pp. Price 5 cents, Superintendent of Documents, Washington, D. C.

Dams, small:

Report on design of dams in planning small water projects, National Resources Committee, Feb. 1, 1937, in 13 chapters, mimeographed preliminary edition.

Drainage basins:

Drainage Basin Study, Abel Wolman. Extension remarks of Hon. Royal S. Copeland, United States Senate, Cong. Record, Feb. 11, 1937, vol. 81, no. 29, pp. 1422–24.

Foundations:

Foundation engineering by geophysics illus., F. M. S. Johnson, The Military Engineer, March-April, 1937, vol. 29, no. 164, pp. 121–125.

Grand Coulee Dam:

Channel excavation at Grand Coulee, illus., Western Construction News, February 1937, vol. 12, no. 2, pp. 70–71.

Great Plains Report:

The future of the Great Plains, by Hon. Maury Maverick, Cong. Record, Feb. 17, 1937, vol. 81, no. 33, pp. 1649–50.

Water conservation in the northern Great Plains, by L. C. Tschudy, illus., Agricultural Engineering, Feb. 1937, vol. 18, no. 2, pp. 63–64 and 67.

Report, December 1936, 194 pages, illus., Report of the Great Plains Committee, price 40 cents, Superintendent of Documents, Government Printing Office, Washington, D. C.

Gordon, Grant:

A 200,000-cubic yard slide held by freezing glacial silt, illus., Water Works Engineering, Feb. 17, 1937, vol. 90, no. 4, pp. 218, 219 and 236–239.

Arch dam of ice stops slide, illus., Eng. News-Record, Feb. 11, 1937, vol. 118, no. 6, pp. 211–215. (Editorial p. 236.)

Hutchins, Wells A.:

Administrative control of underground water: Physical and legal aspects, Proc. Am. Soc. C. E., Feb. 1937, vol. 63, no. 2, pp. 323–328.

Ickes, Harold L.:

P. W. A. Administrator moves into new home, illus., of New Interior Building and portrait, The Constructor, Feb. 1937, vol. 19, No. 2, pp. 17–18.

Imperial Dam:

Rock picker takes oversized stone from fills for canal banks, illus., Eng. News-Record, Feb. 25, 1937, vol. 118, no. 8, p. 293.

Kansas:

Water: Its use and control in Kansas, illus., Kansas State Planning Board, October 1936, 28 pp.

Madden Dam:

Grouting pen stocks with coal tar, illus., N. H. Wilson, Military Engineer, March–April 1937, vol. 29, no. 164, pp. 97–100.

Montana:

Montana conserves its water, illus. Series of articles on Montana dams under construction, including Glacier Lake, Cooney, Smith River, and Willow Creek, Pacific Builder and Engineer, November 1936 to January 1937.

Page, John C.:

President names John Page Reclamation Commissioner (portrait). Pacific Builder and Engineer, Feb. 6, 1937, vol. 33, p. 37. (Editorial p. 25.)

Sees tremendous job in conservation and control of country's waters, address at San Antonio, Tex., Southwest Builder and Contractor, Feb. 26, 1937, vol. 89, no. 9, pp. 10–11.

John C. Page receives appointment as United States Commissioner of Reclamation (portrait), Western Construction News, February 1937, vol. 12, no. 2, p. 84.

New Reclamation chief westerner who knows problems of arid West, Southwest Builder and Contractor, Feb. 26, 1937, vol. 89, p. 17.

Parker Dam:

Parker Dam foundation excavation sets record depth of 250 feet, illus., Western Construction News, February 1937, vol. 12, no. 2, pp. 49–51.

Public Works:

Public Works Planning, National Resources Committee, Harold L. Ickes, Chairman, December 1936, 221 pp. Price 60 cents. Superintendent of Documents, Washington, D. C.

Puzzolan, Cement:

Portland-Puzzolan cement in Bonneville spillway dam, illus., R. R. Clark, Eng. News-Record, February 11, 1937, vol. 118, no. 6, pp. 219–222.

Savage, John L.:

Colorado Engineering Council honors John L. Savage, with portrait, Eng. News-Record, March 4, 1937, vol. 118, p. 350.

The billion dollar engineer (portrait of John L. Savage), by Edgar C. McMechen, Colorado Engineers Bulletin, February 1937, vol. 21, pp. 4–7 and 12.

State Planning:

State planning, programs and accomplishments, supplementing State planning report of 1935, December 1936, National Resources Committee, 128 pp. Price 25 cents. Superintendent of Documents, Government Printing Office, Washington, D. C.

Tenancy, Farm:

Message by President with report of the Special Committee on Farm Tenancy, February 16, 1937, H. Doc. 149, 75th Cong., 1st sess., 28 pp.

Vetter, C. P.:

Why desilting works for the All-American Canal? (illus.), Eng. News-Record, March 4, 1937, vol. 118, no. 9, pp. 321–326.

Young, Margaret G.:

Federal Reclamation Laws, Annotated, July 1936 (supersedes 1931 edition), 700 pp. For sale by Bureau of Reclamation, price, paper, $1.25; cloth, $1.50.

TECHNICAL MEMORANDA

A new price list of 543 Technical Memoranda issued by the Chief Engineer of the Bureau of Reclamation, Custom House, Denver, Colo., has just been issued. (26 pages.) It is available for distribution from that office.

Montgomery, F. D.:

Trial load twist and beam analysis of stresses in the Grand Coulee Dam—Joints grouted. Tech. Memorandum, No. 546, Feb. 25, 1937, 15 pages. Price 80 cents.

Vidal, E. N., and W. S. Byrne:

Tests on 18-inch concrete drill cores, Wheeler Dam, T. V. A., Technical Memorandum No. 544, Jan. 26, 1937, 32 pages, including illus. and charts. Price $3.50.

AGRICULTURAL DEPARTMENT BULLETINS

Dasheen:

The Dasheen, a southern root crop for home use and market, Robert A. Young, Farmers Bulletin No. 1396, Department of Agriculture, Dec. 1936. 38 pages. Price 10 cents.

(Continued on p. 90)

Beans for King Tut's Soldiers

By Seth H. Dibble, Assistant Clerk, Milk River Project

IF WE could look beyond the mist of civilization's past, we might learn the name of the Egyptian serf who probably through necessity ate the dried seed of a weed pod, found it palatable, and thereby gave to the world the bean. Crowded in the temple with his brethren in the black darkness before dawn, he had beheld the first rays of the sun strike through the portals and illuminate the sleek body of the bull Apis. Did not the soul of Osiris inhabit the bull Apis? Was not Osiris god of the Nile, and on this longest day did he not visit, by inundation, his wife Isis, who was goddess of the irrigated lands?

Year after year, as far back as memory could recall, on the same day and at almost the same hour, the Nile had risen and irrigated the fertile valley. But this time, seemingly, prayers had failed. The Nile had risen, yes, but not to the usual height. The desert sun had parched the fields and drought had forced the Egyptians to seek anything that might serve as life-giving sustenance. So this valuable food was discovered, and as its nutritious qualities became known the culture of papyrus gave way to the culture of the bean, and it is quite probable that in the year 1400 B. C. the rations of King Tutankhamen's soldiers were composed principally of beans, as have been the rations of the fighting men of every civilized nation up to the present day.

Beans were in the vanguard of American civilization. They were in the hold of the *Mayflower*, and with the Lincolns when they crossed into Kentucky. Easily transported and unlikely to spoil, they formed a goodly share of the stores trekked across the plains during the days of "Forty-nine." They sustained the hoary prospector while seeking his visionary "Eldorado" in the distant hills, and coming down to the present time beans were on the menu of the irrigation engineer while he harassed sullen deserts until they divulged immense granaries hidden beneath.

Just as beans were grown by irrigation thousands of years ago, so are they grown today. Surely their value as an irrigated crop is time-tested.

The success attained by irrigation projects under the Carey Act of August 18, 1894, proved that irrigation must mother agricultural development in Montana, and an appeal was made for Federal aid. June 17, 1902, the date the Federal Government approved the Reclamation Act, marks the beginning of the flow of "liquid gold" over her semiarid lands. Quartz and placer had lured the hardy prospector and frontiersman to her shining mountains in early days, and now "liquid gold" from those same mountain streams beckoned to farmers on crowded, sickly eastern lands.

The Huntley project, some 3,000 feet above sea level, was the first Government project to be started in Montana, and, incidentally, the first to be opened for settlement. These fertile clay silts, lying along the south side of the Yellowstone River not far from Billings, have been "panned" for alfalfa and beans, sugar beets, and grains since 1907; so let us scan the statistics of this mother project for proof of the value of bean culture on irrigated lands. We will take the cases of two representative farmers, probably on slightly different types of soil and we know growing different types of beans, since farmer no. 1 grew garden beans and farmer no. 2 harvested Great Northern, pinto, and chili strains.

	Cost per acre	
	Farmer no. 1	Farmer no. 2
Seed	$2.40	$3.00
Plowing, harrowing, leveling	5.00	5.00
Seeding	.50	.40
Cultivating	[1] 1.50	[3] 3.00
Irrigating	[2] 2.00	3.00
Weeding	1.00	2.50
Hail insurance	2 60	3.00
Cutting and piling	1.60	2.50
Threshing	5.90	4.60
Cost not including land and water rental	22.50	27.00
Average yield per acre hundredweight	19.00	15.00
Average price	$4.00	$3.50
Average value straw per acre	$3.00	$3.00
Gross income	$79.00	$55.50
Net income	$56.50	$28.50

[1] 3 times. [2] 5 times. [3] 4 times.

Compare these returns with any other irrigated product from the same class of lands and an average of $42.50 per acre is well worthy of much consideration.

It has been pointed out that bean acreage is limited, since they are adverse to growing on heavy or alkaline soils; and that salvage is nil in case of destruction by hail. It is not urged that beans compose the entire crop. Diversification is the essence of any well balanced unit and, as the storing of the crop presents no serious problem, beans can be made to supply needed funds while other crops are maturescent.

So it seems quite fitting and proper that a monument be erected to the memory of that Egyptian serf, whom drought forced to eat a weed, for down through the ages this leguminous plant, more nutritious than wheat and containing twice its nitrogenous content, has done its share in uncovering rich metals, exploring new lands, and in building the sinews of war. Beans, delicious, builder of both brawn and brain, are our heritage from a scourged slave, whom Nature chose to bless humanity.

Articles on Irrigation

(Continued from p. 89)

Farm gardens:

Subsistence farm gardens, illus., W. R. Beattie and others, Farmers Bulletin, No. 1746, 54 pages, Department of Agriculture. Price 10 cents.

Sweet potatoes:

The sweet potato weevil and how to control it, Agriculture Department leaflet No. 121, 1937, 6 pages.

Trees:

Planting and care of street trees, illus., F. L. Mulford, Farmers Bulletin No. 1209, January 1937, 29 pages. Price 5 cents. Department of Agriculture.

Reclamation Crop Values

Preliminary estimates indicate that crops on Federal reclamation projects in 1936 had a value of $78,473,385, an increase of $14,841,722 over 1935 and of $46,872,303 over 1932, the low year of the depression. Last year's production by the operating projects came within $10,000,000 of the highest record so far made and brought the cumulative volume of crops from these projects since 1906, the year the first of them went into production, to a grand total of $1,423,810,339.

The average value of crops harvested on reclamation projects last year was $48.20 per acre. This contrasts with $39.65 per acre during 1935, indicating that the depression is over so far as these western irrigated areas are concerned.

The water supply on the operating projects last year was ample, except on two projects situated in the heart of the drought area. These two projects, Belle Fourche in South Dakota and North Platte in Nebraska and Wyoming, suffered some shortage of water due to the cumulative effects of several years of deficient rainfall.

Despite this condition, however, the average value of crops on the Belle Fourche project in 1936 was $26.05 an acre against $22.30 in 1935, and the average on the North Platte project was $39.40 per acre against $26.10 in 1935.

Notes for Contractors

Specification no.	Bid opening	Project	Work or material	Low bidder: Name	Low bidder: Address	Bid	Terms	Contract awarded
	1937							
872-D	Feb. 4	Riverton, Wyo.	Clearing Bull Lake reservoir site.	Nevada Construction Co.	Nevada, Mo.	$16,400.00		Feb. 24
874-D	Feb. 8	do	1 crawler-traction-mounted, full-revolving, Diesel-engine-powered, convertible-type dragline excavator.	Bay City Shovels, Inc.	Bay City, Mich	13,500.00	F. o. b. Bay City, 2 percent discount.	Mar. 4
877-D	Feb. 15	Boulder Canyon, Ariz.-Nev.	Metalwork, including steel frame building, chutes, hoppers, etc., for concrete mixing plant.	Pittsburgh-Des Moines Steel Co	Des Moines, Iowa	5,963.00	F. o. b. Des Moines, ½ percent discount.	Mar. 5
880-D	Feb. 24	All-American Canal, Ariz.-Calif.	Steel and aluminum windows, doors and louvers for control houses of desilting works at Imperial Dam.	Security Products Co.	St. Louis, Mo.	569.00	F. o. b. Yuma, Ariz., 1 percent discount.	Mar. 6
				Kawneer Co.	Niles, Mich.	960.00	F. o. b. Niles, Mich.	Mar. 8
				Metal Door & Trim Co	La Porte, Ind.	960.00	F. o. b. La Porte, Ind., 1 percent discount	Mar. 9
				A. J. Bayer Co.	Los Angeles, Calif.	1,200.00	F. o. b. Los Angeles	Mar. 10
42,652-B	Jan. 14	Salt River, Ariz.	12,000 barrels of Portland cement in cloth sacks.	Southwestern Portland Cement Co.	do	24,744.00	F. o. b. Monolith, 60 cents discount and sacks.	Mar 8
2,278-A	Jan. 29	Carlsbad, N. Mex.	6,000 barrels of Portland cement in cloth sacks.	Colorado Portland Cement Co.	Portland, Colo	20,310.00	F. o. b. Fort Sumner, 50 cents discount, and sacks.	Do.
42,632-A-1	Feb. 17	Salt River, Ariz.	Steel reinforcement bars, 1,115,025 pounds.	Concrete Engineering Co.	Omaha, Nebr.	30,441.37	F. o. b. Duluth, ½ percent discount.	Mar. 4
44,116-A-1	Mar. 1	Parker Dam, Ariz.-Calif.	Steel reinforcement bars, 684,000 pounds.	Soule Steel Co.	San Francisco, Calif.	18,140.00		Mar. 3
	1936							
713	Dec. 29	All-American Canal, Calif.	Construction of railroad and highway siphons at stations 3579, 3683, 3710, and 3772.	Lewis Chambers Construction Co.	New Orleans, La	106,528.50		Mar. 12
879-D	Feb. 23	Central Valley, Calif.	Materials for steel warehouse building at Friant camp.	Ingalls Iron Works Co.	Birmingham, Ala	2,910.00		Mar. 3
878 D	Feb. 17	Carlsbad, N. Mex.	3 45-foot by 21-foot automatic radial gates.	John W. Beam	Denver, Colo.	27,300.00	F. o. b. Peotone, Ill.	Mar. 16
		Riverton, Wyo.	3 29-foot by 11-foot automatic radial gates.					
884-D	Feb. 23	Shoshone-Heart Mountain, Wyo.	Preparation of concrete aggregates.	Taggart Construction Co.	Cody, Wyo.	41,750.00		Mar. 13
36,237-A	do	Owyhee, Oreg.-Idaho.	25,000 barrels of Portland cement in cloth sacks.	Oregon-Portland Cement Co.	Portland, Oreg	60,000.00	F. o. b. Lime, Oreg., 50 cents discount and sacks.	Mar. 16
708	Feb. 15	All-American Canal, Calif.	Concrete drops and power house substructures at drops 2, 3, 4, and 5.	Pleasant-Hassler Construction Co.	Phoenix, Ariz.	410,896.50	Schedules 1 and 2	Mar. 19
				Frank J. Kernan and John Klug.	North Portland, Oreg.	398,934.30	Schedules 3 and 4	Do.

Retirement of Thomas Bann, Yuma Project

By R. C. E. Weber, Superintendent

Thomas Bann retired at the close of February 28, 1937, as ditch rider on the Yuma project, Arizona, having attained during the month the retirement age of 65 years recently established by the Department of the Interior and the United States Civil Service Commission for the position of ditch rider.

Mr. Bann entered the employ of the Reclamation Bureau on April 1, 1913, as a patrolman in the Valley division of the Yuma project. He was subsequently advanced to the position of subforeman, and on November 15, 1915, was appointed ditch rider with one horse as automobiles were not then in universal use. On April 1, 1920, he was employed as ditch rider with auto, in which capacity he has since been actively engaged.

Mr. and Mrs. Bann were the guests of honor at a meeting held in the Gadsden Community House on February 24, which was attended by their numerous friends in Yuma Valley as well as in Yuma. Many of those present were water users whom Mr. Bann had served in the delivery of water during his employment by the Bureau as ditch rider. There was also present a number of officials of the Yuma County Water Users' Association. At this meeting Mr. and Mrs. Bann were presented with two overstuffed chairs as a token of the esteem and respect in which they are held by their friends and neighbors.

On the eve of his retirement from active duty Mr. and Mrs. Bann were the surprise guests at a party at the home of I. D. Cress, a fellow project ditch rider. At this meeting, which was attended by members of the Yuma project operating and headquarters office forces, Mr. Bann was presented with a Gladstone traveling bag, accompanied by the following letter:

DEAR MR. BANN: On the occasion of your retirement tomorrow from the Reclamation Bureau after 24 years of service on the Yuma project, your fellow employees join in felicitating you on your attaining retirement age and in expressing the wish that many years will be allotted to you in health and vigor for the fullest enjoyment of your retiring from the work that has occupied your time for these many years.

THOMAS BANN, RETIRED

In commemoration of the event the following have contributed to a farewell

(Continued on p. 92)

Reclamation Organization Activities and Project Visitors

John C. Page, Commissioner of Reclamation, appeared before the Appropriations Committee of the House of Representatives commencing March 30 in justification of the Bureau's budget for appropriations for the next fiscal year.

The following field officers visited the Washington office during the month of March:

B. E. Stoutemyer, district counsel, Portland, Oreg., called in by Solicitor for the Department of the Interior Margold in connection with legal matters affecting the Bureau.

F. A. Banks, construction engineer of the Columbia Basin project, Washington, and Frank L. Maynard, senior clerk, for a conference with the Board of Labor Review, Public Works Administration.

Wesley R. Nelson, engineer in the Washington office, attended a meeting in Chicago on March 4 of Committee D-18, Soils for Engineering Purposes, of the American Society for Testing Materials. Mr. Nelson is secretary of the main committee and chairman of the subcommittee on mechanical stability of soils.

Miss Mae A. Schnurr, Assistant to the Commissioner, will address a civic group of Chester, Pa., on April 20, on the subject of Boulder Dam, illustrated by lantern slides. A new four-reel motion picture of Boulder Dam with sound track will be exhibited following the lecture.

I. M. Brandjord, Land Commissioner for the State of Montana, and formerly a member of the President's Committee on Conservation and Administration of the Public Domain, has been named director of public welfare for the State of Montana, in which capacity he will administer Montana's $6,000,000-a-year social-security program. Mr. Brandjord resigns from his present position of Land Commissioner on April 16 and will be succeeded by Mrs. Nanita Sherlock by appointment of the Governor.

Recent visitors to the Yuma project were—

H. M. Knapp, of the soil conservation service, Safford, Ariz., who collected samples of bamboo cane for test purposes:

James J. Madden, Jr., assistant district counsel, Bureau of Reclamation, Los Angeles, Calif.;

L. H. Trimble, general passenger and freight agent, Southern Pacific Co., Phoenix, Ariz.;

W. V. Russell, manager, Kittitas reclamation district, Ellensburg, Wash., who inspected the Yuma project irrigation system, agricultural development, and operating methods.

George O. Sanford, General Supervisor of Operation and Maintenance, delivered an illustrated address on Power Development at Boulder and Grand Coulee Dams at a joint meeting on the evening of February 18 of the Academy of Science and the Washington sections of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and the Washington post of the Society of American Military Engineers.

J. L. Savage, chief designing engineer, and F. F. Smith, senior engineer, of the Denver office, visited Alamogordo Dam, Carlsbad project, New Mexico, late in February and inspected the work in progress.

Frank J. Haas Dies

The sudden death of Frank J. Haas, Secretary of the Bard Irrigation District, Yuma, Ariz., occurred on March 12, as the result of a heart attack. Mr. Haas was appointed Secretary of the District in January last, to succeed David H. Dow who resigned to leave the Yuma project and take up his residence in Oregon.

L. N. McClellan, Chief Electrical Engineer, Bureau of Reclamation; D. S. Worden, President, National Reclamation Association, Great Falls, Mont.; Capt. Ralph E. Cruse, Corps of Engineers, United States Army; Frank C. Wright, representative of the Secretary of the Interior and Chairman of the Committee to Study Power Problems in Arizona; and H. E. Robbins, Bureau of Reclamation, Phoenix, Ariz., were among the recent visitors to the Boulder Canyon project.

George A. Bonnet, of the Denver office, was called to Washington the latter part of February because of the illness of his mother, whose death occurred on March 2.

The appointment of Cleves H. Howell, Jr., to the position of junior engineer, Rio Grande investigations, Pagosa Springs, Colo., was authorized by the Secretary of the Interior in February. This assignment terminated Mr. Howell's appointment as junior hydraulic engineer in the field service of the Geological Survey.

The following transfers of Bureau employees were made during the month of February from Denver:

Swante H. Aho, Loren E. Bishop, Leonard Kuiper, and Raymond K. Benson, inspectors; and Henry E. Stradley, Jr., junior engineer, to the Heart Mountain division, Shoshone project, Cody, Wyo.

William A. Gordon, inspector; W. Ray Anderson, engineering draftsman; and James C. Doman, assistant engineering draftsman, to the Upper Snake River project, Ashton, Idaho.

Edgar O. Baird, inspector, to the Humboldt project, Reno, Nev.

Jacob J. Berger, assistant engineer, and J. Neil Murdock, junior engineer, to the Salt Lake Basin project (Provo River project), Salt Lake City, Utah.

Ross D. Billings, inspector, to the Salt Lake Basin project, Salt Lake City, Utah.

William F. Bingham, associate engineer; and John C. Bowman, Daniel Morgan, and Carl F. Olsen, inspectors, to the Moon Lake project near Duchesne, Utah.

Virgil G. Fahrney, assistant engineer, and Charles N. Cairns, junior engineer, to the Owyhee project, Boise, Idaho.

George J. Cheney, from the position of junior engineer to that of assistant engineer, Bartlett Dam, Salt River project, Phoenix, Ariz.

John H. Gibson, inspector, to the Ogden River project, Ogden, Utah.

Thos. Bann Retires

(Continued from p. 91)

remembrance as a token of their esteem and regard:

F. W. Adams.	E. E. McCombs.
N. O. Anderson.	Tom Marrs.
Henry Bandy.	E. J. Painter.
Dixie Bann.	W. H. Porter.
T. J. Benton.	Leland S. Pratt.
W. C. Betts.	Chase Pulsifer.
C. B. Boydston.	Wm. B. Richmond.
Clara Chambers.	C. B. Stanley.
R. H. Cunningham.	L. D. Tevis.
J. T. Davenport.	J. R. Van.
J. C. Hamblen.	R. C. E. Weber.
Vivian Harmon.	C. M. White.
H. C. Hyde.	

Sincerely yours,
(Sgd.) R. C. E. WEBER,
Superintendent.

Mr. Bann retires to live on his 40-acre irrigated ranch in the Valley division of the Yuma project where he will reside in the close environs of the scenes of his long years of service with the Reclamation Bureau.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page**, Commissioner, Bureau of Reclamation
Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr. of Operation and Maintenance; A. R. Golzé, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz	R. B. Williams	Constr. engr	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif
Burnt River	Unity, Oreg	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex
Alamogordo Dam	Ft. Sumner, N. Mex	Wilfred W. Baker	Constr. engr		do	Do.
Casper Alcova	Casper, Wyo	H. W. Bashore	do	C. M. Voyen	W. J. Burke	Billings, Mont
Central Valley	Sacramento, Calif	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg
Frenchtown	Frenchtown, Mont	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila	Yuma, Ariz	R. B. Williams	Constr. engr		R. J. Coffey	Los Angeles, Calif
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah
Humboldt	Reno, Nev	L. J. Foster	Constr. engr	George B. Snow	do	Do
Klamath	Klamath Falls, Oreg	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont	H. V. Hubbell	Constr. engr	do	do	Do
Minidoka	Burley, Idaho	Dana Templin	Acting Supt.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	F. J. Westerhouse	Constr. engr	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam [3]	Parker Dam, Calif	E. A. Moritz	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif
Pine River (Vallecito Dam)	Durango, Colo	Charles A. Burns	do		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do
Rio Grande	El Paso, Tex	L. R. Fiock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex
Caballo Dam	Caballo, N. Mex	S. F. Crecelius	Constr. engr		do	Do
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont
Salt River	Phoenix, Ariz	E. C. Koppen	Constr. engr	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo	Walter F. Kemp	Constr. engr	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Reno, Nev	L. J. Foster	Constr. engr	Geo. B. Snow	J. R. Alexander	Salt Lake City, Utah
Umatilla (McKay Dam)	Pendleton, Oreg	C. L. Tice	Reservoir supt		B. E. Stoutemyer	Portland, Oreg
Uncompahgre: Taylor Park	Gunnison, Colo	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo	C. B. Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage [4]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza div	do	Chas. E. Crownover	Constr. engr	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting. [3] Non-Federal. Island Park and Grassy Lake dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

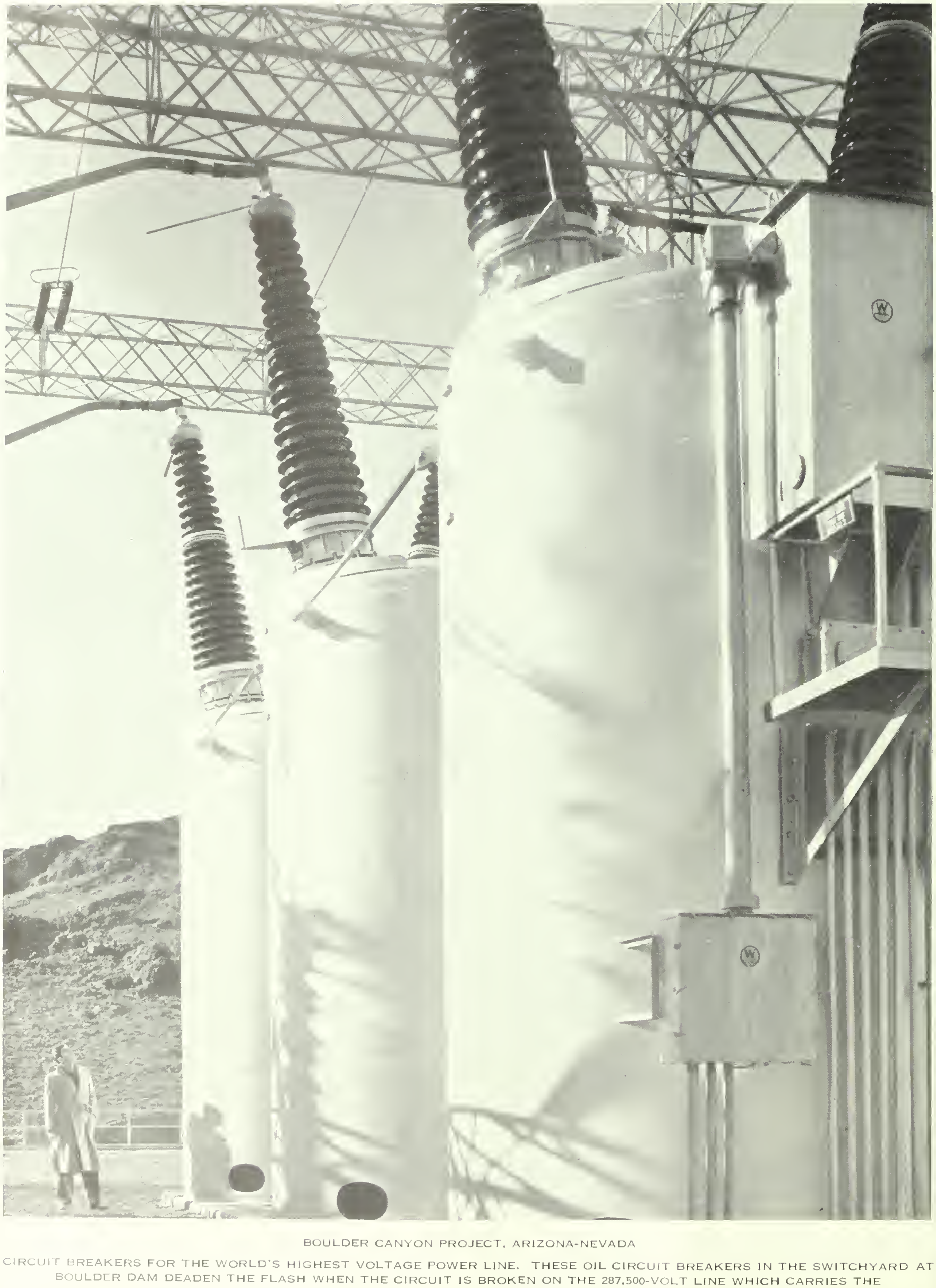
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M. Watson	Caldwell.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo	Charles Tharp	Superintendent	C. J. McCormich	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A	Wellsville, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr	President	Dorothy Eyers	Do.
Lower Yellowstone	Board of Control	Sidney, Mont	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook division [1]	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo	Bert L. Adams	do	Mary Harrach	Torrington.
Northport division	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	Superintendent	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	H. J. Lawson	do	F. C. Henshaw	Phoenix.
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo	F. E. Martin	President	Geo. W. Atkins	Powell.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn	Payson, Utah	William Grotegut	President	E. G. Breeze	Payson.
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D. Martin	Hermiston.
West division	West Extension irrigation district	Irrigon, Oreg	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash	W. V. Russell	Manager	G. L. Sterling	Ellensburg

[1] Operated by 5 irrigation districts

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash	F. A. Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo	Mills E. Bunger	Senior engineer.
Gallatin Valley	Bozeman, Mont	R. R. Robertson	Engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Do.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo	Frank C. Merriell	Do.
Black Hills	Rapid City, S. Dak	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	Denver, Colo	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do
Conchas	Tucumcari, N. Mex	J. A. Keimig	Associate Engineer.
Grande Ronde	La Grande, Oreg	C. C. Fisher	Engineer.

Sallie A. B. Coe, *Editor.*



BOULDER CANYON PROJECT, ARIZONA-NEVADA

CIRCUIT BREAKERS FOR THE WORLD'S HIGHEST VOLTAGE POWER LINE. THESE OIL CIRCUIT BREAKERS IN THE SWITCHYARD AT BOULDER DAM DEADEN THE FLASH WHEN THE CIRCUIT IS BROKEN ON THE 287,500-VOLT LINE WHICH CARRIES THE POWER TO LOS ANGELES, 250 MILES AWAY. THIS LINE CARRIES 287,500 VOLTS AT 1200 AMPERES.

THE RECLAMATION ERA

VOL. 27, NO. 5

MAY 1937

NIGHT VIEW OF DEPARTMENT OF THE INTERIOR (SOUTH BUILDING), NEW HOME OF INTERIOR BUREAUS, INCLUDING THE BUREAU OF RECLAMATION.

Of Interest to Farmers on Federal Reclamation Projects

On April 8 the Secretary of Agriculture submitted recommendations of changes in the pending sugar quota bill (H. R. 5326) to Representative Fred Cummings, of Colorado, chairman of the subcommittee of the House Committee on Agriculture, appointed to hold public hearings and recommend legislation to replace the existing sugar quota laws which expire December 31, 1937. Subsequently, the subcommittee recommended a new bill, known as committee print no. 2, to the full committee in which without exception every recommendation of the administration with respect to the division of quotas was disregarded in favor of a set of provisions believed to have been proposed in large part by the cane refiners. The subcommittee bill has met the strong opposition of the Departments of Agriculture, State, and Interior because it would constitute what is considered to be an indefensible destruction of export trade.

Recently a world agreement was consummated in London among 22 nations providing for a program under which observers believe the price of sugar in the world markets may be advanced substantially. The new world agreement becomes effective in September 1937. In view of the conditions that have been developed by the demands of the Washington representatives of the sugar industry, and in view of an unanticipated consummation of the world agreement with respect to sugar, which removes much of the need for additional sugar quota emergency legislation, the prospects for any sugar legislation at this session of Congress are uncertain at this time.

The following letter by the Secretary of the Interior points out some of the most serious disadvantages of the proposals of the subcommittee from the standpoint of agriculture generally and the public interest:

May 7, 1937.

My Dear Mr. Jones:

Upon examination of Committee Print No. 2, of the sugar quota bill, recommended by the Subcommittee to the full Committee on Agriculture, the Department of the Interior finds four forms of discrimination against Hawaii and Puerto Rico, as insular parts of the United States. If enacted into law, the bill would violate the principle of fair treatment among all domestic areas which the Government has sought to maintain as a fundamental national policy.

The discriminations which appear in Committee Print No. 2 are as follows: (1) The basic quotas for Hawaii and Puerto Rico would be disproportionately small, on any basis that could be selected, as compared with the basic quotas for other domestic sugar-producing areas; (2) as a result of the discriminatory basic quotas for Hawaii and Puerto Rico, the share of these areas in the deficits of other areas and in increased consumption would be commensurately disproportionate; (3) the domestic insular areas would have no minimum quotas, which are provided in Committee Print No. 2 for the mainland sugar-producing areas; and, (4) restrictions would be placed on the right to engage in refining operations in only the insular parts of the United States.

Since the great fundamental principle of American democracy is the equal treatment of all citizens, there is no need to dwell upon the moral or practical necessity of avoiding economic discriminations against the citizens of the United States who may be residing in the insular parts of our country.

None of the discriminations against the insular areas in Committee Print No. 2 existed under the traditional tariff method of subsidizing domestic sugar production; and, of course, there were no discriminations in the quota provisions recommended on April 8 by the Secretary of Agriculture, which are also recommended by the Department of the Interior.

The interest of the Department of the Interior in the sugar problem is, however, not limited to the principle of keeping our trust with the territories and possessions; it is equally interested in the welfare of mainland farmers who utilize reclamation lands and the public domain and, in the broader consideration of the Government, in not breaking faith with the large but unorganized groups of citizens on whom would necessarily be placed the great burden of any further expansion of domestic sugar production.

Although it is clear that any share of deficits or increased consumption allotted to domestic production should be divided equitably, there is reason to doubt that any increase of domestic production should be subsidized. It will be recalled that during the administration of President Wilson, the Congress decided, after careful consideration of the basic question of continuing to subsidize domestic sugar production, that the whole matter was indefensible and forthwith provided for the elimination of all subsidies—a program from which the industry was saved only by the World War and action taken by later administrations.

Since that time the domestic industry has continued to thrive on public subsidies and has expanded into a larger vested interest. During the decade preceding 1934 expansion was accelerated with the consequence that a large portion of Cuban sugar was replaced by production from areas subsidized by American consumers. The transfer of the source of supply from Cuba to the United States has resulted in three principal problems: First, it was necessary to subsidize the production brought to this country; second, it became necessary to provide a partial subsidy to Cubans to relieve the extreme social and economic stress that arose from the absence of the production in Cuba; and, third, it was necessary to subsidize the contraction of the production of export crops for which the foreign market had been in part destroyed. The obvious solution for these interdependent problems would be, of course, to reverse the process of production and, in any event, it would seem that the least the public interest demands is that further expansion of domestic production should not be subsidized.

The Secretary of State pointed out in his statement of April 30 that the consumers in the United States were compelled last year to pay approximately $350,000,000 in excess of world prices for their sugar supply, an amount which was equal to a tax of nearly $3 on every man, woman, and child in this country, including the millions of persons who have a deficient supply of food. This appears to be an excessively large burden to place on American consumers, especially in view of the fact that there are reported to be less than 100,000 farms on which sugar crops are grown in all parts of the United States.

But this great burden on consumers is not the total cost of maintaining the domestic sugar industry, for the producers of exports necessarily suffer a loss in their foreign market whenever our imports are decreased. It has been calculated that each additional average acre of domestic sugar production unavoidably results in a reduction of our export market in an amount equal to the value of the product of three acres of cotton, or three acres of corn, or six acres of wheat. And, of course, any increase of domestic production and decrease of foreign sugar imports involves a loss of revenue to the Treasury of the United States with the result that an additional burden must be borne by American taxpayers.

In these circumstances it would appear that provisions for further expansion of the subsidized vested interest in domestic sugar production would constitute what is practically tantamount to a breach of faith with the interests of consumers, producers of exports, and taxpayers. For this reason the Department of the Interior recommends the elimination of the numerous provisions in various forms in Committee Print No. 2 for increased quotas for domestic sugar production.

A sugar quota system possesses the advantage, from the standpoint of domestic sugar producers, of raising prices and profits to a much higher level than would ensue from ordinary tariff protection. It has been calculated, for instance, that the prices paid for sugar by consumers in 1936 were approximately $145,000,000 in excess of the prices that would have existed under an effective tariff on Cuban sugars of $1.50 per hundred pounds, raw value, as recommended by the United States Tariff Commission.

In addition to the greater cost it imposes on consumers, a quota system appears to possess inherently the serious disadvantage from the standpoint of the public interest of tending to become a great mass of fixed individual monopolies which prevent those increases in efficiency that could come from the normal movement of production to the better-adapted domestic areas. If the usual free movement of production were permitted among domestic areas, there is reason to believe that no total shift would occur between the insular and continental portions of the United States because Report No. 73 of the United States Tariff Commission indicates that the average cost of production of refined beet sugar is no greater than the average cost of the production of refined cane sugar in the insular areas. But there probably would be some improvements in efficiency in the continental areas, if restraints were removed, through the tendency of production to move to the lower-cost and better-adapted locations.

A sugar quota system in the form in which it has been conceived heretofore can serve the public interest by restraining the expansion of heavily subsidized domestic production and stabilizing conditions within the industry. But its basic advantage would be lost and replaced by a most serious public disadvantage if its purpose were perverted into a device for the destruction of trade in our most efficiently produced commodities.

A great weakness of a sugar quota system as an instrument of regulation by political government lies in its extremely technical nature and its complex ramifications. This characteristic makes it susceptible to great abuse by organized minority pressure groups who can take advantage of its technical complexities to devise so many means of fixing embargoes against competition and of increasing their own share of the total increased income that a quota system provides for the industry as a whole.

At the present time in Washington we have not only the sugar lobbies which are kept here in season and out but also a large supply of temporary sugar lobbyists who are busily soliciting support for all sorts of devices and schemes they have concocted to obtain special governmental grants of monopoly. The audacity of one little group of manufacturing monopolists, the cane refiners, in demanding a legalized monopoly for themselves, illustrates the difficulties that Congress must face under a quota system in dealing with corporate aggregations of wealth which control the necessities of the daily life of our citizens. This, despite the long court record of this group in restraint of trade and the fact that the United States Tariff Commission investigated their claims and found they were not warranted in seeking governmental protection against even foreign competition. They insist on a legalized monopoly for themselves through embargoes against both domestic and foreign competition and demand that the Congress, without hesitation, snuff out forthwith another $3,000,000 of annual import and export trade.

The Department of the Interior believes that no quota legislation at this time would be greatly preferable to the enactment of the provisions of Committee Print No. 2.

Sincerely yours,

(Sgd.) Harold L. Ickes,
Secretary of the Interior.

Hon. Marvin Jones,
Chairman, Committee on Agriculture,
House of Representatives.

Facts About Interior Department (South Building)

By Mae A. Schnurr, Assistant to the Commissioner

WHEN this issue of the Reclamation Era reaches you, we will be housed in our beautiful new building, a night view of which appears on the front cover page. The location of our quarters is designated on the view of the building which appears on this page.

This new building, erected as a project of the Public Works Administration, is the first major Federal Government structure in Washington authorized, designed, and built by the Roosevelt Administration. The estimated total cost of the building is $13,000,000, inclusive of land. The building covers approximately 5½ acres. It consists of a center wing two blocks long, from C to E Streets, with six wings on each side, extending through from Eighteenth to Nineteenth Streets. Every room is an outside room with courts between the wings open to the streets, providing maximum light and air.

HAS ALL MODERN CONVENIENCES

This new building was built with the paramount thought in mind of getting under one roof the personnel of the Interior Department employed in Washington, D. C. The building is simple and modern in design. It has unusual facilities and operation programs planned to reduce maintenance and operation costs to a minimum and utilize every square inch of space to the best advantage. Something about the building problems involved may be gleaned from the boxcar figures on different units required For instance, there are 3,681 inside doors, not counting those within rooms leading to clothes closets, etc.; 4,432 windows; 1,000 electric clocks; 3 miles of corridors; 20 high-speed passenger elevators; 11 stairways running the height of the building; 4 escalators—2 up and 2 down—between the basement and the second floor. A picture of one of these appears on the next page.

LANDSCAPING

Landscaped treatment of a type particularly appropriate to areas in business districts and which offers more for a practical solution of the downtown park problem generally will be a feature of the grounds surrounding the Interior Building and Rawlins Park, which separates, by a square's breadth, the new building from the north Interior Building. Trees capable of withstanding the adverse growing conditions in Washington's downtown sections, yet ornamental in appearance, will be utilized for the street planning. To eliminate the continuous and expensive maintenance of turf on the north and east sides of the building, evergreen ground cover will be substituted For similar practical reasons, evergreen will be employed for the hedges and shrubbery around the building.

MAGNOLIA PARKWAY

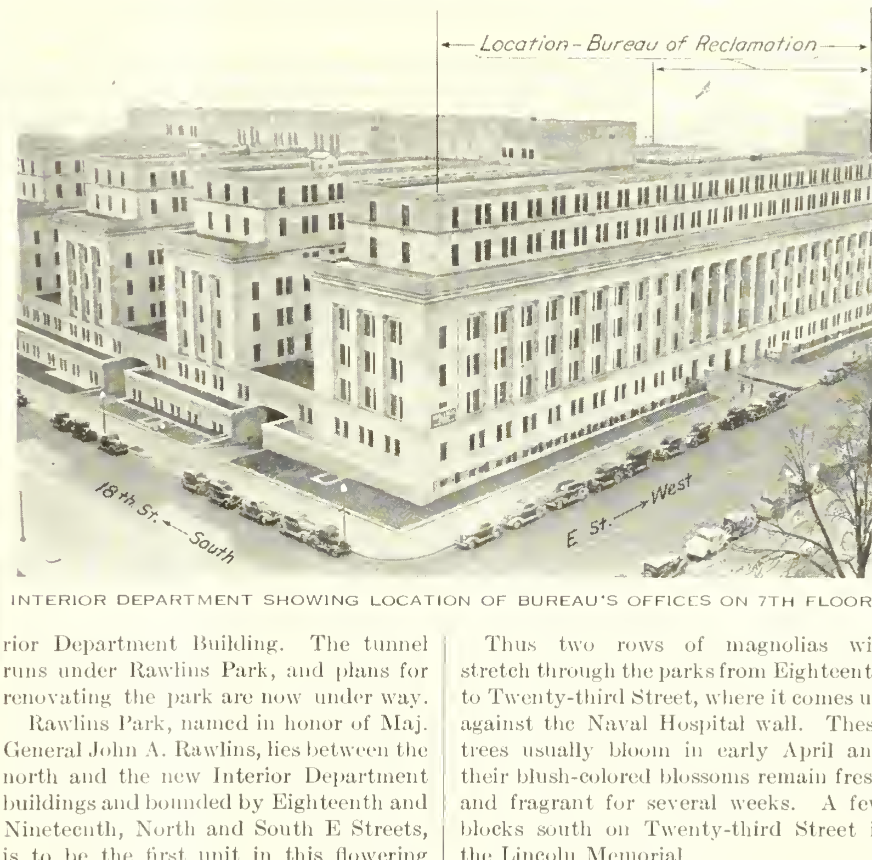
An avenue of blooming magnolia trees will eventually stretch from Eighteenth and E Streets westward to the Naval Hospital grounds at Twenty-third Street in a series of small parks forming a little mall.

The new building is connected by a 150-yard tunnel with the old north Interior Department Building. The tunnel runs under Rawlins Park, and plans for renovating the park are now under way.

Rawlins Park, named in honor of Maj. General John A. Rawlins, lies between the north and the new Interior Department buildings and bounded by Eighteenth and Nineteenth, North and South E Streets, is to be the first unit in this flowering parkway. The central axis of Rawlins Park, now being relandscaped as part of the new Interior Building program, runs east and west through the length of the park. This axis will be extended for an additional four blocks through similar parks, which are to be developed when necessary land titles are acquired.

All the parks will be the width of Rawlins Park, bounded on the north by North E Street as it is now and on the south by a new street which must be cut through and which will be known as South E Street. At present South E Street runs only the one block from Eighteenth to Nineteenth Street. Its extension will necessitate realinement of New York Avenue and other streets.

Twenty-six magnolias will be planted along the broad walks marking the axis of Rawlins Park and at intervals they will border long, narrow, reflecting pools. Two of the other four parks planned are to be the same size as Rawlins and will each have 26 magnolias, while two parks, just as wide but shorter because of block lengths, will each require about a dozen of the trees.



INTERIOR DEPARTMENT SHOWING LOCATION OF BUREAU'S OFFICES ON 7TH FLOOR

Thus two rows of magnolias will stretch through the parks from Eighteenth to Twenty-third Street, where it comes up against the Naval Hospital wall. These trees usually bloom in early April and their blush-colored blossoms remain fresh and fragrant for several weeks. A few blocks south on Twenty-third Street is the Lincoln Memorial.

INTERIOR DEPARTMENT (NORTH BUILDING)

The old building houses the Public Works Administration; the Geological Survey, which has not been moved because of its many laboratories and operating facilities in the old building; the Photographic Laboratories; the National Bituminous Coal Commission; the Puerto Rico Reconstruction Administration; and a portion of Emergency Conservation Work offices of the National Park Service

The north building population will total 3,500 people, of whom 2,800 are P. W. A. personnel.

The completion of this building and the moving of bureaus like ours to their own department building releases badly needed space in other Government buildings and in leased quarters. It effects a much better operating arrangement because of close proximity of the personnel of bureaus to officials of the Department with whom they deal.

The building has a completely automatic air-conditioning system and heat control; modern automatic watchmen and fire arrangement systems; and automatic sprinkler systems covering the garage areas and some large storage areas. The average office is 13 by 18 feet with an 11-foot ceiling.

The annual saving in rent to the Federal Government, because of moving its units from leased buildings to the new Interior Department building, will amount to $181,350 per year. Departmental activities will be transferred from nine leased buildings and six Government-owned buildings, vacating an area of approximately 480,500 square feet. There will be approximately 5,000 persons housed in the south building.

DEPARTMENT UNITS IN NEW BUILDING

The units of the Department which are housed in the new building are the Office of the Secretary of the Interior, the Solicitor, the General Land Office, the Office of Indian Affairs, Office of Education, Bureau of Reclamation, National Park Service, Division of Territories and Island Possessions, Division of Grazing, Division of Geographic Names, Bureau of Mines, National Capital Park and Planning Commission, and the Commission of Fine Arts.

NEW AUDITORIUM

On the first floor to the right as you enter the main entrance to the building on C Street is a well-equipped auditorium with seats for about a thousand persons. It is acoustically treated, as are the ceilings throughout the entire building. In the auditorium conferences and educational meetings will be held. It is equipped for the showing of sound films.

EXHIBIT GALLERY

On the first floor an entire wing will be given over to show cases and wall exhibits of various bureaus of the Department. This is a feature that is very much needed for educational purposes. Here visitors to Washington can see in exhibit form the various activities of the Department, and those interested in special problems will be directed to the specific offices, which can supply detail on any special subjects.

THE CAFETERIA

The cafeteria is located in the basement and is one of the largest in Washington. It could serve 1,200 persons at one time. There are four steam tables so that four lines can move at once. It is equipped with 26,100 pieces of china, 12,120 pieces of silver, and with two dish-washing machines which can scrub 200 pieces of china per minute.

GARAGE

The basement houses a garage for cars of officials and a general garage for those of employees. Special outlets are provided for automotive gases so that there will be no danger of carbon-monoxide fumes gathering or explosive gases forming. Ramp runways lead directly to the garages from the street, and other ramps are provided for supply trucks to use in loading and unloading.

BROADCASTING STATION

For the first time in the construction of a Government building, plans call for erection of a broadcasting studio. This will be built after the building is occupied. It will be used for educational broadcasts by bureaus of the Interior Department and other Government departments.

ESCALATOR OPERATING BETWEEN BASEMENT AND 2D FLOOR

Riverton Project Active

Market conditions on the Riverton project, Wyoming, continue excellent. From January 1 to March 31, 10 privately owned farms were sold involving an irrigable area of 825 acres. Other sales are in prospect. In addition, a number of sales of land have been made for which water is not yet available. The project office anticipates settlement during the present year of a substantial number of new families.

Three public land farm units are still available for settlement.

Hearings on Boulder Dam Power Contracts

Opening Remarks by Professor Charles E. Merriam

THIS hearing was called by Secretary of the Interior Harold L. Ickes because of requests made of him to consider modification of the Boulder Dam power contracts. The major request for such revision comes from the Metropolitan Water District of Southern California. The law now provides that contracts may be revised at the end of 15 years and then every 10 years. Because of the interest of Members of Congress at the last session of Congress, a rider was attached to the McNary bill (S. 4695) relating to the Bonneville Dam project, to authorize modification of the contracts. However, the bill did not pass.

Secretary Ickes had hoped to conduct this hearing in person and it was he who issued the invitations. He is forced to be away, however, and has asked me to preside and to report to him the record and my findings.

The invitees include all the contracting parties and others specially interested. It is my desire and intention to allow all of those invited to have a reasonable time to state their views. Because of the number of State and local governments, as well as other organizations, represented here it has been necessary in the interest of time saving to limit the length of each statement to be made. It was for this reason that Secretary Ickes in his telegram of invitation suggested that written briefs might be filed to supplement the oral argument to be made here.

As you all know, the Boulder Dam power contracts provide that any changes or modifications entered into with one of the contracting parties shall be effective as to the others. This was one of the reasons that impelled Secretary Ickes to invite all of you to meet here so that the matter could be discussed openly and facts developed as a basis for action by the Secretary of the Interior, including possible recommendations to Congress. It is unlikely that much can be done without authorizing legislation. This hearing is solely for the purpose of discovering the full extent of the need, if any, for modification or change.

The Government by calling this hearing obviously does not bind itself to make any modifications in general or in particular.

It has recently been proposed that a rider be attached to the bills now pending before Congress with regard to the administration of the Bonneville Dam project. I may say that Secretary Ickes, because the problems of Boulder and Bonneville are entirely dissimilar, does not favor such a rider.

In order that the matter may be presented to us in a little more historical detail, I have asked Mr. John C. Page, Commissioner of Reclamation, to make an opening statement.

Statement by Mr. John C. Page, Commissioner of Reclamation

THE Bureau of Reclamation is not at this time advocating revisions of the Boulder power contracts. It has given consideration, however, to the requests of some of the power contractors for revision of their contracts to determine the results of the proposed revisions as a basis for administrative action by the Department. There are several features of the present power contracts which are not satisfactory from the Government's standpoint and if revisions are undertaken, these matters can be adjusted at the same time.

The Boulder Canyon Project Act established a special fund of not to exceed $165,000,000 for construction of the Boulder Canyon project. All advances to this fund are to be repaid, and the amounts used for construction of Boulder Dam and power plant are to be repaid within 50 years with interest at the rate of 4 per centum per annum compounded annually. The sum of $25,000,000 of the cost of Boulder Dam is allocated to flood control. If during the period of amortization revenues are in excess of the amounts necessary to meet the periodical payments to the United States, 18¾ percent of such excess revenues is to be paid to each of the States of Arizona and Nevada, in lieu of taxes which these States might have received had the Boulder power development been a private undertaking, and 62½ percent of such excess revenues is to be applied to repayment of the $25,000,000 allocated to flood control.

After the repayments to the United States of all money advanced with interest, the revenues are to be kept in a separate fund to be expended within the Colorado River Basin as may hereafter be prescribed by the Congress.

POWER CONTRACTS

Before any money could be expended for construction of the project, the Secretary of the Interior was required to secure contracts for sale of electrical energy and stored water which would produce sufficient net revenues, after providing for operation and maintenance of the project, to repay the cost of the project within 50 years. Repayment of the amount allocated to flood control may be deferred if revenues are insufficient to permit such repayment. The Boulder Canyon Project Act provides that the contracts covering sale of electrical energy and water shall produce reasonable returns and it also provides for readjustment of such contracts, either upward or downward, as to price as justified by competitive conditions at distributing points or competitive centers. Such adjustments are to be made at the end of 15 years from the date of the contracts and each 10 years thereafter.

The charges for use of falling water of 1.63 mills per kilowatt-hour for generation of firm energy and ½ mill per kilowatt-hour for generation of secondary energy were determined in accordance with the provisions of section 5 (a) and (c) of the Boulder Canyon Project Act on the basis of the cost of competitive power from private and municipal plants delivered at the load center at Los Angeles, at the time the power contracts were entered into (1930), less the estimated cost of transmitting Boulder Dam power to that load center. Under the present power contracts a large amount of money will accumulate in the special fund to be expended within the Colorado River Basin in accordance with the provision of section 5 of the Boulder Canyon Project Act, in excess of the amounts required to cover the cost of operation and maintenance of the project and to amortize the entire construction cost, including the $25,000,000 allocated to flood control. If the present charges are continued in effect without revision throughout the amortization period, the entire cost of the project will be amortized in considerably less than 50 years.

In addition to the charges for use of falling water for generation of firm and secondary energy the power contractors are required to amortize the cost of generating equipment, which is purchased and installed by and title to which is retained by the United States, in 10 equal annual instalments. The power contractors are also required to bear the costs

of operation, maintenance, and depreciation of the generating equipment.

OPERATION OF PRESENT CONTRACTS

Under the present power contracts the dam and reservoir, the penstocks and outlet pipes and Boulder City are to be operated and maintained by the United States. The release of water from the reservoir will be controlled by the United States and the operation of the power plant will be under the supervision of a director appointed by the Secretary. The power plant is to be operated and maintained, under lease, part by the city of Los Angeles and part by Southern California Edison Co., Ltd. The city is to generate power for itself and for the States of Arizona and Nevada, the Metropolitan Water District of Southern California, and the municipalities of Burbank, Glendale, and Pasadena. The Edison Co. is to generate power for itself and the Nevada-California Electric Corporation.

The Metropolitan Water District, the largest single contractor for Boulder power has requested that its contract be revised so as to relieve the district of having to pay for large amounts of electrical energy that it is obligated to pay for but which it will be unable to use during the early period of operation of its aqueduct. The district also requests that the power contracts be revised to provide for operation of the entire power plant by the Government, for amortization of the cost of generating equipment in 50 years in lieu of 10 years and for operation of the district's transmission lines by the district in lieu of by the city of Los Angeles.

Any reduction in charges for falling water would be reflected in corresponding reduction in the excess revenues available for repayment of the $25,000,000 allocated to flood control and for payments to the States of Arizona and Nevada. It would also result in retarding the payments of the cost of the project and delay the time when funds will be available for expenditure within the Colorado River Basin. Any deferment of the Metropolitan Water District's obligations would be reflected in corresponding deferment in the Government's revenues. If a decision should be reached to reduce the charges for falling water, or to grant relief to the Metropolitan Water District, and, at the same time, to leave undisturbed the interests of the Colorado River Basin States, it would be necessary for the Congress to revise the Boulder Canyon Project Act.

Operation of Boulder Dam and power plant by the Government, the city of Los Angeles, and the Southern California Edison Co. involves duplication of personnel and will result in needless expense. Considerable saving in the cost of operation and maintenance and reduction in spare equipment could be effected by Government operation of the entire project.

Under the present power contracts the city of Los Angeles is designated the generating agent for all State power. The State of Nevada now desires delivery of a relatively small amount of power and the city is not willing to supply this power from its generating units. The city contends, and not without justification, that the connection of the transmission line serving Nevada users to the city's generators would constitute a hazard to service to the city's important load.

It is not practical to install a large generating unit solely to supply a relatively small amount of power to the State if the entire cost of such a unit must be amortized by the contractors who purchase power through the State. Under such conditions the cost of power would be prohibitive. Therefore it seems that some modification of the arrangement for generation and delivery of power to the States is necessary if the use of Boulder power in the States is to be encouraged.

Amortization of the cost of generating equipment during the first 10-year period is an unnecessary burden on the power contractors. This will be the most difficult period for the power contractors to repay the cost of the generating equipment because this will be the development period when their revenues will be the least. Changing the amortization of cost of generating equipment to a 50-year basis would greatly simplify the accounting and administrative procedure and would relieve the purchasers of power of a heavy financial burden during the first 10-year period. Such a change would not adversely affect the interests of the Government, except that repayment of this part of the cost of the project would require a longer time.

It is believed that it would be to the best interests of the Government as well as of the power contractors to have the entire power plant operated and maintained by the Government and to deliver power to all contractors at the high-voltage switching stations. The power contractors would then be charged a "readiness to serve" charge in lieu of the cost of operation and maintenance and amortization of generating equipment. Such an arrangement would facilitate the use of power by the States of Arizona and Nevada, effect considerable saving in the cost of operation and maintenance of the project, reduce the financial burden on the power contractors during the first 10-year period, and eliminate the possibility of friction between different operating organizations in the same power plant.

Press Release by Secretary of the Interior Ickes on Hearings

HEARING into the proposed revisions of the Boulder Dam power contracts opened on April 16, in the Secretary's conference room on the fifth floor (southwest corner) of the Interior Department Building. Charles E. Merriam, professor of political science at the University of Chicago and a member of the advisory board, National Resources Committee, presided as master of chancery. All agencies holding Boulder Dam power purchase contracts and Governors of the four upper basin States—Colorado, New Mexico, Utah, and Wyoming—were invited to attend or send representatives. Those present and participating were:

Representing the city of Pasadena, Calif., a power contractor: C. W. Koiner, city manager, and B. F. Delanty, general manager of the light and power department.

Representing the city of Los Angeles, Calif., a power contractor: E. F. Scattergood, chief electrical engineer and general manager of the bureau of power and light; S. B. Robinson, and William J. Carr, attorneys of the department of water and power.

Representing the Nevada-California Electric Corporation, a power contractor: A. B. West, president, and Frank P. Doherty, attorney.

Representing the city of Glendale, Calif., a power contractor: Aubrey N. Irwin, city attorney, and Peter Diederich, superintendent of the water and power department.

Representing the city of Burbank, Calif., a power contractor: Howard L. Stites, city manager.

Representing the Southern California Edison Co., a power contractor: Fred B. Lewis, vice president and general manager.

Representing the Metropolitan Water District of Southern California, a power contractor: James H. Howard, general counsel; J. M. Gaylord, chief electrical engineer, and Otto R. Emme, director.

Representing Arizona, a power allottee: Governor R. C. Stanford.

Representing Nevada, a power allottee: Alfred M. Smith, State engineer and secretary of the Nevada-Colorado River Commission; Jay A. Carpenter, industrial engineer of the Nevada-Colorado River

Commission; A. E. Cahlon, publisher and editor, Las Vegas Review; and Ed Clark.

Representing New Mexico: Judge David Chavez, member Interstate Streams Commission, and A. T. Hannett, former governor and member of Interstate Streams Commission.

Representing Wyoming: Ray E. Lee, attorney general.

Representing Colorado: Byron G. Rogers, attorney general, and L. Ward Bannister, attorney.

Representing Utah: William W. Ray, member of the Utah Colorado River Commission.

Representing the Imperial Irrigation District, El Centro, Calif.: Phil D. Swing.

Representing the Gila project, Yuma, Ariz.: Hugo Farmer, secretary, Yuma-Gila Irrigation District.

Representing the Aguila Power District, Aguila, Ariz.: Albert Stetson.

United States Senators Hatch and Chavez of New Mexico; Pittman and McCarran of Nevada; O'Mahoney and Schwartz of Wyoming; Ashurst of Arizona; and Adams and Johnson of Colorado.

A majority of Members of Congress from the interested States.

The Government was represented by the following: John C. Page, commissioner; L. N. McClellan, chief electrical engineer; and William E. Warne, of the Bureau of Reclamation; Dr. Clark Foreman of the Public Works Administration, Power Division; Carl L. Farbach, Public Works Administration, Legal Division; Joel D. Wolfsohn, executive secretary, National Power Policy Commission, and Wright L. Felt, acting State director for Nevada of the Public Works Administration.

The purpose of the hearing was to offer the power contractors opportunity formally to present their requests for revision of power contracts, and investigate the merits of the requests.

Contracts for the sale of the hydroelectric energy to be produced at the Boulder Dam plant were executed in 1930, prior to the commencement of construction of Boulder Dam, in accordance with provisions of the Boulder Canyon Project Act of 1928. Under the contracts, power is sold as falling water measured in energy delivered at the switching yards at the rates of 1.63 mills for firm and one-half mill for secondary power.

The initial installation at the power plant has been completed, and at this time four generators of 82,500 kilovolt-ampere capacity are in operation on the line serving the city of Los Angeles. The production during the past few months has climbed to almost 100,000,000 kilowatt-hours per month.

(Continued on p. 101)

Salt River Delegation Visits Bartlett Dam Site

By E. C. Koppen, Construction Engineer, Salt River Project

A GROUP of about 100 people, including the Board of Governors, the Council, officials, and interested farmers of the Salt River project journeyed to the Bartlett Dam site on March 11 to celebrate the placing of the first concrete in the new storage dam. A similar group visited the dam site exactly a year ago. On their first visit there was some doubt as to whether Bartlett Dam would ever be built. On the recent visit the group saw rapid progress being made in the construction of the dam.

The building of Bartlett Dam is an outstanding milestone in the development of 242,000 acres of fine farm land in the Valley of the Sun. This truly wonderful project and the fine modern city of Phoenix have sprung up from the ashes of the ancient Indian civilization of the stone axe and the stone hoe, which flourished here ages ago. Bartlett Dam will be outstanding because it will harness the floods on the uncontrolled Verde River and make them avialable for irrigation, and thus forever remove the threat of water famine.

Present storage for the Salt River project is restricted to the Salt River. Here, at the head of a deep and magnificent canyon, is the Roosevelt Dam and Reservoir with its large capacity of 1,637,000 acre-feet; but this reservoir can only store those waters which flow into it, and during the past 10 years the inflow has been relatively small. There are other reservoirs below Roosevelt—Horse Mesa, Mormon Flat, and Stewart Mountain, but those are mainly for power development and provide usable storage capacity for irrigation only when Roosevelt reservoir is full. Bartlett Dam, with 200,000 acre-feet of storage brings a new stream into the picture. The Bartlett reservoir will be filled at least once, and possibly several times, during each season. In operation, Bartlett storage will be used at the beginning of the irrigation season to make way for the storage of summer floods, thus making it possible to conserve water on the Salt River where large storage capacity is available. Storage release from Bartlett will join the Salt River about 1 mile above the Granite Reef Dam, where diversions are made into the project canals.

BARTLETT DAM TO BE LARGEST OF ITS TYPE

The Bartlett Dam will be a multiple arch with maximum height of 270 feet and will be the highest of this type. There will be 10 arches with span of 60 feet and a short gravity section at each end, the total length being about 800 feet. The spillway at the north end will have a capacity of 175,000 cubic feet per second; discharge will be controlled by three 50-by 50-foot fixed-wheel gates.

The contractor is the Barrett & Hilp and Macco Corporation of Los Angeles. They have built a fine camp with the facilities of a modern city. They have brought in first-class equipment, much of it being new and purchased especially for this job. The contractor was delayed by floods in February, but they are making good progress and plan on finishing the job ahead of schedule.

MODEL OF BARTLETT DAM

Lin B. Orme, president of the association, acted as chairman of the day. Resident Engineer R. F. Herdman, who is in charge at the Bartlett Dam, gave an interesting talk at the dam site. Mr. Herdman used a model of the dam and pointed out numerous important features, their purpose, and how they fitted into the general plan. William McKinley, construction superintendent for the contractor, explained various construction features and difficulties, and mentioned that they hoped to finish the job well ahead of time. Other speakers at the dinner included T. J. Hughes, chairman of the council, Greig Scott, attorney for the association, and E. C. Koppen, construction engineer for the Bureau.

BARTLETT DAMSITE.
MEMBERS OF THE BOARD OF GOVERNORS AND COUNCIL, AND OTHERS OF THE SALT RIVER VALLEY WATER USERS' ASSOCIATION. MR. HERDMAN HAS JUST FINISHED HIS INTERESTING TALK. NOTE THE MODEL OF THE DAM.

Motion Pictures

The Department of the Interior through its Division of Motion Pictures distributes films of the various Bureaus of the Department. Those available for distribution on Bureau of Reclamation subjects are:

Project	35 mm	16 mm	Type	Reels
Vale	1	2	Silent	1
Owyhee	1		do	1
Boulder Dam	10	10	Both sound and silent.	4
Grand Coulee Dam.	10	20	Silent	4

Films are available to all interested organizations, institutions, and individuals under the following conditions:

1. There are no rental charges for the films. Borrowers will assume responsibility for their return in good condition. Bookings will be scheduled for 1 day's use unless the borrower specifies a longer time, in which instance, the Division will gladly comply with reasonable requests.

2. If the shipment weighs only 4 pounds or under (two 16-mm reels or less) it will be sent from the Division to the borrower under Government frank and the borrower will return it parcel post or express prepaid. All film shipments weighing over 4 pounds (three or more 16-mm reels and any number of 35-mm reels) will be sent express collect and must be returned express prepaid.

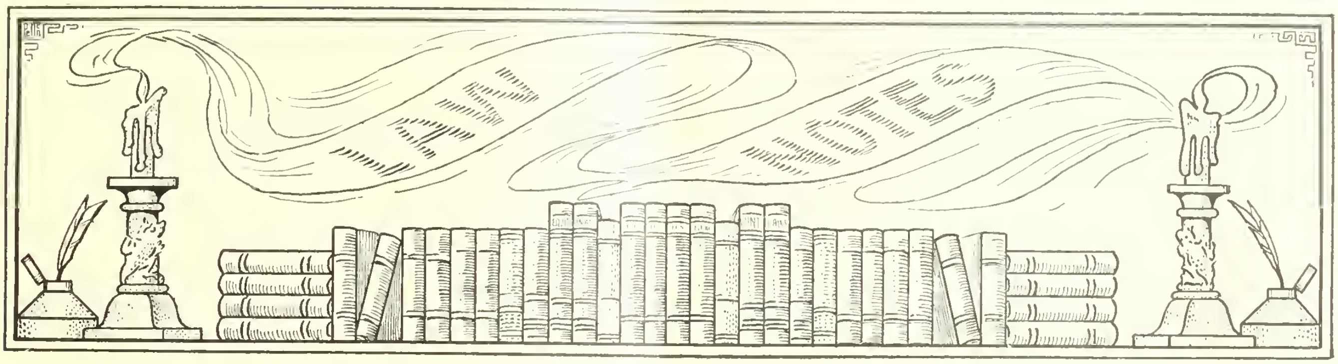
3. Those who desire to purchase prints shall request such authority from the Division of Motion Pictures, indicating clearly the use to be made of the films. The prices now in effect are as follows:

35 mm safety prints, silent, per foot $0.018
35 mm safety prints, sound, per foot 0.018
16 mm reduction prints, silent, per foot 0.015
16 mm reduction prints, sound, per foot 0.0185

4. Films borrowed or purchased will be furnished with the understanding that there shall be no admission or rental fees charged for programs on which the films are used unless they are shown in licensed theaters as parts of regular programs. The regulation against charges is directed at persons who might charge lecture groups to see Government films and at those who might realize revenue from the rental of Government films.

Each request for films should indicate clearly the address to which shipment should be made; the exact dates on which the films will be used (including alternate dates); whether 35 mm (standard width) or 16 mm (narrow width) prints are desired; and whether sound or silent versions are wanted. Unless this information is furnished there will be booking delays.

Application for films should be addressed to the Division of Motion Pictures, Department of the Interior, Washington, D. C.



Federal Condemnation of Land for Dam Site on Navigable River of United States

(Continued from the April issue)

THE appellant, however, contends that while the right to the river bed and to the flowing water of the river for navigation vested in the appellee, appellant had a claim of *inherent adaptability* in the uplands taken in the construction of the dam for "use in the development of electrical power." The development of electrical power in this case, it may be said, is purely incidental. *Ashwander* v. *Tennessee Valley Authority*, 297 U. S. 288 (80 Law. Ed. 827).

The public right of navigation is the dominant right. The right to control such water for navigation is one of the great powers delegated to the United States for the purpose of regulating commerce. The Supreme Court, in discussing riparian rights to submerged land, said: "By necessary implication from the dominant right of navigation title to such submerged land is acquired and held subject to the power of Congress to deepen the water over such lands or use them for any structure which the interests of navigation, in its judgment, may require." *Lewis Blue Point Oyster Company* v. *Briggs*, 229 U. S. 82.

By the same token the appellants have, as against the dominant right of navigation, no private property right in uplands "*adaptable to special use*" in connection with the flooding of such uplands by the construction of a dam for navigation purposes, above the reasonable market value to which the land is adaptable now or in the reasonably near future for any purpose (not including, however, any hypothetical additional value to the owner, who had no "right to appropriate the water to his personal use").

The following from the Supreme Court in *U. S.* v. *Chandler-Dunbar*, supra, at page 76, is decisive:

"The Government had dominance over the waters of the rapids and falls and *cannot be required to pay any hypothetical additional value to a riparian owner who had no right to appropriate the currents to his own personal use.* These additional values represent, therefore, no actual loss and there would be no justice in paying for a loss suffered by no one. '* * * The question is what has the owner lost and not what the taker gained.'" [Italics supplied.]

No persuasive merit is impressed by argument that the Court in this case was dealing with water power as a separate unit of property, and inherent adaptability of the land ("hypothetical additional value") as here contended for was not considered. All the expressions of the Court in relation to each other, considered as a whole in disposition of the issue before it, are to the contrary.

It is axiomatic that if the riparian owner has no right to approach the river as against the right of navigation, he has no inherent right of value "adaptable to special use" over and above the reasonable market value of the upland for any purpose to which it may reasonably be adapted now, or in a reasonable time in the future. This was fairly submitted to the jury. This issue is no newly created relation or right, but has existed long prior to the private ownership in the land. The rights were fixed and relations established by the adoption of the Constitution.

The claim of appellants has no substance, it has no possessory status; it is based upon something which is not possessed, and not being possessed, it has to appellants no value, and appellants lost nothing. The *question is, what have appellants lost, not what appellee gained. Boiston* v. *C. of C. of Boston*, 217 U. S. 189, 194.

It may also be said that the lands had no inherent value for the purposes claimed by the appellants, unless in probable combination with other lands, for private use. There is no evidence that there was any reasonable probability of combination in a *reasonably near future*, or at all of these lands for private use. No capital was seeking the lands for use. When diversity of ownership is considered (900 private owners—600 parcels) Government lands, State lands, Indian Reservation land, Indian allotted land, withdrawal of reclamation lands, the full control of the United States of the water and river bed for navigation (see *Olsen* v. *United States*, 292 U. S. 246), the capital required for investment and consideration of the testimony of conditions in districts to which capital did go and judicial knowledge of the congressional attitude with relation to such permission, and the requirements for the granting of such benefits; the population in the tributary territory, and other hydro-electric plants, Priest Rapids Washington Power Co., including Chelan Falls and a number of other subsidiaries, Bonneville, city of Seattle Department of Lighting (Steam Plant and Skagit Project), Federal Power Commission project no. 552, and project no. 1215, Puget Sound Power and Light Co., including following plants: (Nooksacks Falls, Baker River, White River, Shuffleton Steam) Tacoma Railway, Light & Power (including Lake Cushman Plant), Idaho Light & Power Co., in tributary territory of the Grand Coulee Dam. (*Greeson* v. *Imperial Irr. Dist.*, 59 Fed. (2d) 530 (9 C. C. A.) at 531; *Miller* v. *Oregon*, 208 U. S. 412; The Appollon, 22 U. S. 362 (9 Wheat.), there is not left the shadow of a doubt that there was no reasonable probability of utilizing this land by private capital. There was no offer of proof that this land was sought by private capital; that there was any movement to interest private capital. On the contrary, the testimony shows that all of the agitation had been for a Government dam. The speculative theorizing of expert witnesses as to private capital's seeking this site for development is of no value. *McCandless* v. *U. S. case*,

298 U. S. 342, decided May 18, 1936, points the way. The owners' land was adaptable for growing sugarcane if supplied with water for irrigation. The owners offered to prove that they had facilities by which this water could be produced at a more reasonable expense than was delivered to other lands in the same community; that the raising of sugarcane was profitable; that there were available artesian basins of fresh water amounting to approximately 60,000,000 gallons per day; that they owned lands within these basins upon which wells may be sunk; that it was economically feasible to transport such water from these wells to the land in question; that use of such water was a reasonable certainty; that the cost of transporting the water would be less per million gallons than that incurred for other cane land on the Island of Oahu. This evidence was rejected. The offer of proof was denied and the Supreme Court held that the rule in condemnation cases is that the most profitable use to which the land can probably be put in the *reasonably near future* has a bearing on the market value; and the fact that such use can be made only in connection with other lands does not necessarily exclude it from consideration *if the possibility of such connection is reasonably sufficient* to affect the market value. [Italics supplied.]

There is no such record here. No proof was produced, no offer was made, of any possibility, reasonably near or remote or at any time, that the land would be or could be so used. There is no error.

Affirmed.

Senator Bankhead Visits Salt River Project

Senator John H. Bankhead of Alabama, Chairman of the Senate Committee on Irrigation and Reclamation, visited Tucson, Ariz., in March, and after a short stay he was met at Coolidge by H. J. Lawson and Lin B. Orme, general superintendent and president, respectively, of the Salt River Valley Water Users' Association, by whom he was shown over a number of the project farms.

The Senator was greatly impressed with the aims and results of irrigation, and at a dinner tendered him at the Westward Ho in Phoenix he made an excellent talk in which he stressed the importance of regular and systematic repayments to the Government by the various projects of construction charges if further appropriations for the work are to be expected.

Present at the dinner, in addition to Senator Bankhead and Messrs. Lawson and Orme, were the following: Grieg Scott, attorney, and Mr. Galland, treasurer, of the association; Mr. Betts, chairman of the Arizona Corporation Commission; Mr. Peterson, county commissioner; Mr. Conway, attorney general for Arizona; Messrs. Undall, Mayor, and Jennings, attorney of the city of Phoenix; Mr. Herdman, resident engineer at Bartlett; Mr. Fraps, resident engineer for the work on Salt River; and E. C. Koppen, construction engineer, Salt River project.

LEFT TO RIGHT: H. J. LAWSON, GEN. SUPT. AND CHIEF ENGR., SALT RIVER VALLEY WATER USERS' ASSN.; R. KENWORTHY, SECRETARY, SAN CARLOS IRRIGATION DISTRICT; LIN B. ORME, PRESIDENT, SALT RIVER VALLEY W. U. A.; K. K. HERMES; SENATOR W. B. BANKHEAD OF ALABAMA; GRIEG SCOTT, LEGAL ADVISER, SALT RIVER VALLEY W. U. A.; PETER ETHINGTON, PRESIDENT, AND L. M. NOWELL, DIRECTOR, SAN CARLOS IRRIGATION DISTRICT

Excerpts from March Project Reports

Belle Fourche.—Late lambs went to market during the month and brought the best prices of the season, some shippers receiving $11.50 to $12 at Sioux City. Lambing is well along and has occupied the close attention of sheep men for the past 30 days. Reports indicate a good crop of slightly more than 100 percent, although the cold weather and storm of the last week in the month hindered operations and caused some losses where suitable protection was lacking.

Riverton.—Local dealers report that barley, oats, and wheat prices are the highest reached in the past 5 years, and the price of butterfat is the highest in 6 years.

Yuma.—Spring lettuce was cut at an accelerated rate throughout the month owing to the unprecedentedly high prices. Yields as high as 175 crates per acre were reported. The demand for lettuce from the project was excellent, making it possible to profitably market inferior grades.

Grand Valley.—A considerable amount of Colorado No. 13 seed corn, a new variety to the valley, is to be planted this season. Max Bainter, of Mack, a project farmer, produced 81 bushels per acre on 4.5 acres during 1936. Extensive preparations are being made to combat the alfalfa weevil this season. The county agent is cooperating by publishing dates on which it should be sprayed and instructions for spraying.

Provo River.—Prices for hay and grain remained high. Marketing conditions for dairy and poultry products continued good and top prices were obtained for celery and potatoes held over in storage from last fall.

Yakima.—An estimated additional 500 acres have been planted this year to asparagus in the lower Yakima Valley, representing a cost of about $25,000. This crop has proved to be a profitable one. Canneries were offering 5 cents a pound for canning asparagus late in the month. The 1937 asparagus season opened on March 27 with an express shipment of 20 crates from the Kennewick district. Yakima Valley members of the Washington Cooperative Egg and Poultry Association are sharing in the distribution of a reserve surplus of $4,601, from the association's 1936 operations. Valley members also received $11,557 in the form of preferred stock.

Shoshone.—Project farmers are very optimistic at the beginning of this irrigation season. If satisfactory crops are raised and prices are as good as they were in 1936, it is believed that the farmers on this project will be in as good a financial condition or better than ever before.

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Contract Hearings

(Continued from p. 97)

Units to serve other power purchasers now are being installed or designed.

Revenues this year are estimated at about $1,500,000. The contracts provide an income sufficient to repay the cost of Boulder Dam and power plant in 50 years with interest at 4 percent and to create a large surplus in which the States of Arizona and Nevada will participate and which will be available for use in the States of the upper Colorado River basin for reclamation improvements as directed by the Congress.

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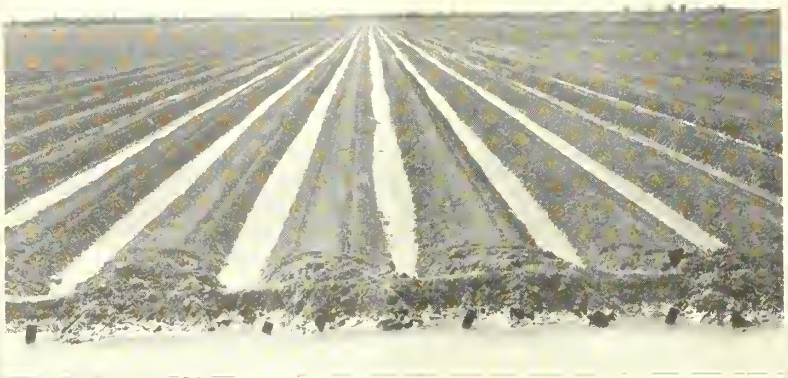
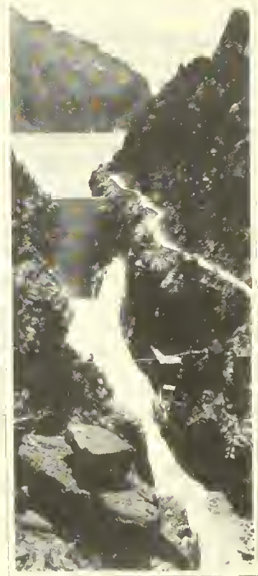
ARIZONA DESERT



A NEWLY IRRIGATED FIELD



SHOSHONE DAM—POWER PLANT

Power Development on Federal Reclamation Projects [1]

AS A part of the broad conservation program which was undertaken by the Federal Government at the beginning of this century, the Bureau of Reclamation was established by Congress in 1902. The purpose was to reinvest revenues from the sale of western public lands in irrigation projects which would help in the development of the arid and semiarid States of the West.

The Bureau of Reclamation was assigned the task of conserving the waters, the fundamental resource of the West, and of putting them to beneficial use.

In the 35 years of the life of the Bureau, 68 dams and reservoirs have been constructed to regulate streams and conserve water which is now being supplied for the irrigation of 2,800,000 acres, once dry and useless. Homes have been created in previously uninhabitable deserts for about 840,000 people, and more than a billion dollars worth of taxable property has been created in 15 Western States.

The benefits of this work to the Western States, and hence to the Nation, were illustrated most dramatically in 1934 and again in 1936, when droughts reduced vast surrounding areas to a dust pan, leaving only the irrigated oases to avert complete disaster.

Lying between the 100th meridian and the Pacific Ocean are about 600 million acres of land. This formerly was represented in the geographies as deserts. It constitutes one-third of the area of continental United States. Much of this expanse is covered with rich soil, but the annual rainfall, except in a narrow strip extending northward from San Francisco Bay, ranges between 3 and 20 inches. Twenty inches, the maximum, is insufficient to sustain an intensive agriculture. Three inches will not sustain life.

It was apparent that under natural conditions civilization could not have advanced in this area beyond the simplest pastoral stage. In prehistoric times the Indians practiced irrigation whenever pueblo existence developed out of their primitive civilizations. The Spanish missionaries in California and Arizona, and the Mormons in Utah, the first white settlers to penetrate this area, turned to irrigation to support the settlements they founded. All of those who came later have followed their examples.

Water is available for only a small fraction of the millions of acres of rich but dry land. Even with the complete development of all of the rivers and streams of these Western States, there will be sufficient water to irrigate only a little more than a fifth of the area. Hence, little more than a fifth of this section can ever be farmed.

It did not take the white pioneers long to make all the easy and cheap diversions from these western streams. By 1902, when the Bureau was established, private interests had exhausted their abilities to provide additional irrigation works. Potential developments then remaining, with few exceptions, were too costly to be financed by individuals or by their cooperative effort through irrigation districts. However, the critical need for the construction of additional storage dams and for the regulation of water supplies still existed. The demand within the Western States for an expansion of the irrigated areas was increasing. Building these storage works, conserving these water supplies, and providing new homes for the expanding population was the job undertaken by the Bureau of Reclamation.

EXPANSION OF IRRIGATION CONSTRUCTION THE NATION'S JOB

In adopting Federal Reclamation as a national policy, Congress stipulated that the cost of construction of these Federal irrigation projects should be levied against the lands benefited.

In its operation under this law, the Bureau has spent about $262,000,000 in the construction of projects. Of this sum, a total of $16,900,000 has become due for repayment by the contracting water users. Collections under these contracts approximate 99 percent.

In the course of constructing its very earliest irrigation projects, the Bureau built its first power plants. They were small and were designed to provide power during the construction period, thus to

[1] Paper prepared by George O. Sanford, General Supervisor of Operation and Maintenance, Bureau of Reclamation, and presented by B. E. Hayden, superintendent of the Klamath project, at meeting in Corvallis, Oreg., of the Institute of Irrigation Agriculture, Apr. 1, 1937.

reduce costs. Later, power developments were undertaken to provide energy for pumps used in irrigation and drainage. In more recent years the development of power has in some instances been inseparable from irrigation. This has resulted from the fact that projects progressively have become more and more complex. Power revenues were needed to reduce the charges against the land and to make the projects economically feasible.

POWER GENERATION

So far, 23 hydroelectric plants, with an installed operating capacity of 131,337 kilovolt-amperes, have been constructed at a cost of approximately $9,328,000 on 12 of the 39 operating projects of the Bureau. The total hydroelectric power production on Federal Reclamation projects for the fiscal year ending June 30, 1936, was 507,761,378 kilowatt-hours. The gross power sales amounted to approximately $3,315,000.

These figures do not include the Boulder Canyon project, which began operation in September 1936. Power produced by plants on Federal Reclamation projects up to the date when the Boulder Dam plant went into operation was relatively small. With the completion of Boulder Dam, which now is producing about 80,000,000 kilowatt-hours a month, and with the development of the Central Valley project in California, the Columbia Basin project (Grand Coulee) in Washington, and the Casper-Alcova project in Wyoming, Federal Reclamation hydroelectric operations promise to become an important factor in the field of power generation.

The first installation was made on the Salt River project in Arizona. In the construction of the Roosevelt Dam, the engineers were confronted with the problem of obtaining cheap power. It was solved by the construction of a low diversion weir and power canal leading to the dam site. Work was started in 1903, and a 1,300-horsepower plant was operating in the spring of 1906. This plant not only furnished power for the construction of the dam, but also for the operation of a cement mill which manufactured 338,452 barrels of cement with a saving of approximately $600,000.

Similar situations arose in connection with the construction of the Strawberry Tunnel of the Strawberry Valley project in Utah, in construction of the Arrowrock Dam of the Boise project in Idaho, and in other work. They were met in each case by the installation of a small power plant. These plants were figured in as a part of the construction cost of the project involved and are being repaid by the water users.

A second type of power development was undertaken to provide energy for pumping for irrigation and drainage. Plants of this type were designed as a part of the waterworks. Examples are the 10,000-kilovolt-ampere Black Canyon power plant on the Boise project, completed in December 1925, used primarily for pumping irrigating water on the Owyhee project, and the Siphon Drop plant on the Yuma project in Arizona, which develops about 1,000 kilowatts under a 10-foot head and furnishes power for pumping at a cost of only 0.8 cent per kilowatt-hour, as compared with 2.8 cents per kilowatt-hour formerly paid for purchased power.

Whether power plants were installed for construction or for pumping purposes, opportunities arose for the sale of power for commercial uses. There developed concurrently problems with respect to rates to be charged and the allocation of costs and revenues.

MULTIPLE-PURPOSE DAMS

Before going into these matters in detail, a third and highly important type of irrigation and power project should be recognized. It is epitomized by Boulder Dam, and is the type of project in which power generation is deliberately included as a major consideration, and in which the sale of power is expected to repay or to contribute largely to the repayment of the cost of construction. While projects in this class are dependent upon power generation and sale for their existence, since otherwise they could not be financed, they are not "power projects." They are something more. In each case, power remains the by-product of the primary conservation objectives, water supply, flood control, and river regulation.

Boulder Dam of the Boulder Canyon project, Kennett Dam of the Central Valley project in California, Grand Coulee Dam of the Columbia Basin project in Washington, and Seminoe Dam of the Casper-Alcova project in Wyoming, four members of this third group, can best be described as multiple-purpose dams. Each is the keystone of a comprehensive program for use of a major water resource.

"Combination of irrigation and power obviously brings about a double use of water and thus increases the value and overall efficiency of that water", John W. Haw and F. E. Schmitt, serving as an independent commission to investigate the efficacy of the Federal Reclamation policy, reported to Secretary of the Interior Harold L. Ickes. "Full development of power possibilities is therefore desirable in the public interest."

Despite general acceptance of this principle in recent years, there has been no precise and general answer to the question: "Who is entitled to the profits of

BOULDER DAM AT NIGHT

these power plants once their cost has been repaid?"

Congress has spoken several times in this regard. In 1924 it passed a bill which provided that when a project is turned over to the water users for operation and maintenance, the net revenues should be credited annually; first, on account of project construction charge; second, on account of project operation and maintenance charge; and, third, as directed by the water users.

Later special legislation, directed that the net power revenues on certain projects be applied; first, to repayment of the cost of the power system; second, to the repayment of part or all of the cost of special irrigation features; and third, to the reclamation fund.

In the Boulder Canyon Project Act of 1928, Congress required sale of power to repay the cost of Boulder Dam and power plant with interest at 4 percent in 50 years. No interest is involved on projects constructed under the reclamation law.

The project water users have a direct and double interest in the power rates. In many instances they are the consumer of the energy, and therefore have to pay the charges. They are also benefited by the net revenues earned, because these reduce the construction costs which must be assessed against the land.

It is not entirely a case of taking money out of one pocket and putting it into another since a considerable portion of the power is sold to project cities and towns. On the Minidoka project, the largest part of commercial power is sold to the cities of Burley and Rupert, which pay around $12,000 a year.

It is necessary to maintain wholesale rates on a fair and equitable basis. High rates bring protests from the cities. Low rates bring objections from water users.

Revenues received from the sale of surplus power is a most effective method of collecting payment for the indirect benefits which cities and towns derive from irrigation development. This question of payment for indirect benefits has received considerable attention. Where the city has come into existence after irrigation districts have been created and repayment contracts executed, often there is no way but through the sale of power to assess any of the construction cost against the city property.

PROJECT POWER DEVELOPMENT

Brief histories of power developments on various projects, with summaries of their performances, rates, revenues, and obligations will make clear the general condition of the power affairs of the bureau.

Salt River. On the Salt River project in Arizona, a plant of 10,000 kilovolt-amperes was installed at Roosevelt Dam with reclamation funds. The capacity of this plant has been nearly doubled, and seven other plants have been constructed by the Salt River Valley Water Users' Association, which now has a total generating capacity of 83,210 kilovolt-amperes. These plants, operated by the Association, furnish power for irrigation pumping and commerical sale to cities, farms, and mines. The Salt River project has reached a high state of electrical development with 1,365 miles of transmission lines. Every farm on the project is offered service. For the fiscal year ending June 30, 1936, gross power sales amounted to $2,588,677.

Minidoka.—The Minidoka project, where a 10,000 kilovolt-amperes plant was built in 1909 to provide power for pumping on the Burley division, has also reached a high state of development. Surplus power during the winter months is sold at very low rates, making it possible for a large percentage of the homes in the cities and on the farms to be heated by electricity. Rates charged range from a maximum of $2 per kilowatt-month for not less than 3 kilowatts to $1.25 per kilowatt-month for 20 kilowatts or more, which gives a minimum rate of 1.73 mills per kilowatt-hour. The number of farms using electricity has increased steadily from 750 in 1919 to 1,300 in 1936, with an average consumption of 1,500 kilowatt-hours per year. A representative of the Rural Electrification Administration recently made a study on the Minidoka project. He said the rates for farm power were probably lower there than anywhere else in the country.

Newlands.—The Lahontan plant on the Newlands project in Nevada has a capacity of 1,875 kilovolt-amperes using waters from the Truckee canal and from the Lahontan reservoir to develop power. Because there is not sufficient water available in the winter months to operate the plant without loss of water needed for irrigation, this plant is now limited to seasonal power production. When the plant was put in operation in 1912, power was sold to the Sierra Pacific Power Co., but this contract terminated in 1935. The irrigation district now has taken over the operation of the plant and is now furnishing power to the city of Fallon and to adjoining rural communities. Consideration is being given to the construction of reservoirs below Lahontan Dam to store for irrigation water used for generation of power during the winter months and to the construction of a stand-by Diesel plant.

Strawberry Valley.—The operation of the Strawberry Valley plant, constructed in 1909 in Spanish Fork Canyon, with a capacity of 1,000 kilovolt-amperes, was turned over to the water users in 1927. This plant now furnishes power to several corporations and project cities, the principal customers being Payson City and Spanish Fork. Gross power sales amounted to approximately $48,000 last year.

North Platte.—Two plants, the Guernsey and Lingle plants, combined furnish power to the entire North Platte project in Nebraska and Wyoming with lines extending east to Gering, Nebr. Power for construction of the Seminoe and Alcova dams of the Casper-Alcova project, now under construction, also is supplied from these plants. The Lingle plant was built in 1919 to furnish power for electric draglines used in construction of the Fort Laramie Canal. It has a capacity of 1,750 kilovolt-amperes. The Guernsey plant was completed in 1927 with a capacity of 6,000 kilovolt-amperes. The net revenues are credited to the annual construction charges, and in recent years have amounted to almost 60 percent of the total payments due. The gross power sales from these plants during the past fiscal year exceeded $217,000.

Shoshone.—Revenues from the 7,000 kilovolt-amperes Shoshone power plant constructed in 1920 in Wyoming were not sufficient to cover the cost of operation and maintenance until the oil field near Cody was developed. In 1926 the project water users were given an opportunity to participate in the net revenues. By the time they were ready to assume the responsibility of repaying the cost of the power plant, the laws, under which that might have been done on the crop repayment plan, had been repealed. The best terms then available required payment within the remaining 22 of the period of 40 years from the date of the first public notice. Such terms were unacceptable to the district officials.

The act of March 4, 1929, provides that the net revenues from the operation of the Shoshone plant shall be applied, first, to the repayment of the construction cost of the power system; second, to the repayment of the construction cost of Shoshone Dam; and, third, to the reclamation fund. Under the provisions of this act, the water users on the Shoshone project, without expense to themselves, enjoy the benefits of a storage reservoir, which, with dam and power development, cost $2,736,679. Notwithstanding such free service, persistent efforts have been made to have the terms of the act of 1929 changed, first, through court action, which has been denied, and, second, by the repeal of the act and the execution of a contract that would permit

the project water users to share in the net revenues.

Power from Shoshone dam is now being used on the construction of the Heart Mountain division, and is being distributed to all of the principal towns in the Big Horn Basin by the Mountain States Power Co. which purchases all surplus power. The average rate paid for power in 1936 under this contract was 8.7 mills per kilowatt-hour with a maximum demand of 1,400 kilowatts. In addition to this contract, which covers about 95 percent of the output of the plant, there are several small contracts providing for the sale of electrical energy to rural organizations on the Garland and Willwood divisions of the project at rates ranging from 5 cents down to 1 cent per kilowatt-hour, with an average rate of 2.5 cents per kilowatt-hour.

Boise.—In order to increase the output of firm power from the Black Canyon plant on the Boise project, Congress authorized the construction of Deadwood dam and reservoir, and in the act of March 4, 1929, specified that the net revenues derived from the operation of the Black Canyon power plant shall be applied to the repayment of the construction cost, first, of the Deadwood reservoir, second, of the Black Canyon power plant and power system, and, third, of one-half the cost of the Black Canyon Dam. Thereafter, all net revenues shall be covered into the Reclamation Fund unless and until otherwise directed by Congress.

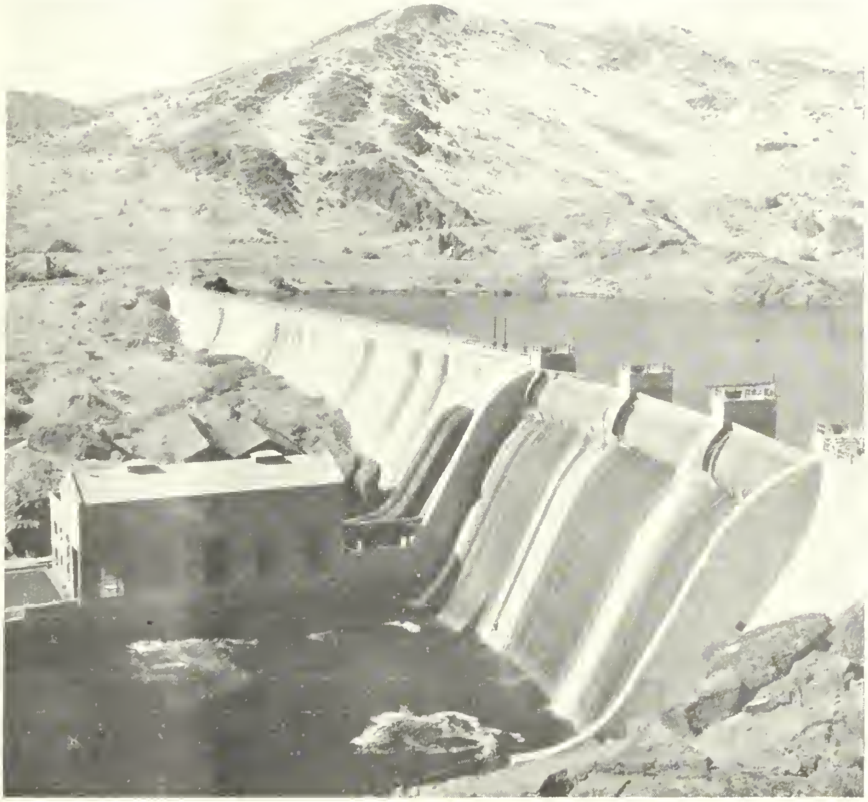
The payments to the Government to apply on the Black Canyon power plant under existing contracts are as follows:

(1) Forty thousand dollars a year paid by the irrigation districts of the Owyhee project for the use of practically all of the irrigation season power available from the Black Canyon plant, except a small amount furnished to the Emmett district for supplemental pumping.

(2) Fifty thousand dollars a year paid out of receipts from power sold to the Minidoka project, the winter power of the Black Canyon power plant being exchanged with the Idaho Power Co. for power delivered by the company on the Minidoka project during the nonirrigation season, so that the Minidoka plant may be practically closed down and the winter flow of Snake River stored for irrigation.

(3) The Emmett irrigation district makes a very small payment each year for power for operating a supplemental pump.

(4) The Idaho Power Company pays $600 a month during the nonirrigation season for operation and maintenance expense of the power plant. The power company also furnishes free transmission service in delivering summer power from the Black Canyon plant to the Owyhee project and delivering winter power from the Black Canyon plant to the Minidoka plant. It also assumes, in exchange for the 5,000 to 6,000 kilowatts available from the Black Canyon plant during the winter, the obligation of furnishing, free of charge, during the irrigation season, 4,000 kilowatts of firm power generated at the company's plants, and furnishing, during the nonirrigation season, all the power needed on the Minidoka project up to 10,000 kilowatts. As a part consideration for the payments and the power deliveries above referred to, the power company receives any surplus power that may be available from the Black Canyon plant.



BLACK CANYON DAM AND POWER PLANT

Riverton.—Revenues from the 2,000 kilovolt-amperes Pilot Butte power plant on the Riverton project in Wyoming have thus far been barely sufficient to cover the cost of operation and maintenance, notwithstanding that the rates on surplus power are the highest in the Bureau. They start at 5 cents per kilowatt-hour and average approximately $0.024 per kilowatt-hour. A minimum payment of $1,500 a month is paid under the contract with the Mountain States Power Company.

Yuma.—The Siphon Drop power plant on the Yuma project reduced by more than 50 percent the cost of power for drainage pumps on the Valley division and irrigation pumps on the Yuma Mesa. Rates have ranged from 1.4 cents per kilowatt-hour in 1926 to approximately 5 mills for 1937. All pumping for irrigation is confined to the daylight hours, and a large amount of surplus power has been sold to the Southern Sierras Co. For the first 10 years the rates paid by the company for surplus energy were 1 cent per kilowatt-hour from 8 a. m. to 8 p. m. and three-fourths of a cent for the remainder of the day. Since 1936, the rates received for surplus energy have been 6 mills during the 12 hours from 8 a. m. to 8 p. m. and 4 mills for the other half of the day. This plant has been highly profitable due largely to the favorable contract with the Southern Sierras Power Co. which affords a market for all surplus energy available. The net revenues have been considerably in excess of the installments necessary to repay the cost of this power plant.

Yakima.—The construction of the Prosser power plant on the Yakima project was authorized by the act of May 14, 1930, which provided that all net revenues received from the sale of power not required for pumping on the Kennewick Irrigation District, shall be applied, first, to the payment of the construction cost incurred by the United States in connection with the Kennewick highline unit, including power plant and appurtenances, until said construction cost is fully paid, and thereafter to the

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retirement of the obligations incurred by the said district in the purchase of the Prosser dam and right-of-way. Power is sold to several districts at a rate of 2.75 mills per kilowatt-hour. Surplus power is sold to the Pacific Light and Power Co. at 1½ mills per kilowatt-hour during the winter months and 2 mills per kilowatt-hour during the summer months, yielding slightly over $12,000 per year. The rate on power from the Prosser plant for pumping is lower than that on any other Federal Reclamation project.

Grand Valley.—In 1931 the Public Service Co. of Colorado advanced $215,000 for construction of a power plant completed in 1933 on the Grand Valley project. The company will operate and maintain the plant for 25 years, and will pay $15,000 per year for falling water besides a rate of 1½ mills per kilowatt-hour for all energy developed in excess of 15,000,000 kilowatt-hours per year. At the end of 25 years, the plant is to be released to the Water Users' Association. Revenues apply on operation and maintenance cost of the project.

Boulder Canyon.—These power plants have been important factors in the success of the projects, despite the fact that combined they are small in comparison with the 1,317,500 kilovolt amperes Boulder Dam plant. I will not attempt here to give a detailed description of the Boulder Canyon development, but a brief discussion of its financial status may be of special interest.

Firm energy is sold to the purchasers as falling water at 1.63 mills per kilwatt-hour, measured in terms of energy at transmission voltage. Dump energy on which the Metropolitan Water District has first option to utilize for pumping purposes, is sold at half a mill per kilowatt-hour. By selling the power as falling water, the purchasers are required to operate and maintain and amortize the cost of the power generating equipment.

The income from Boulder Dam power during the first year of full operation will be $7,057,900 for 4,330,000,000 kilowatt-hours of primary energy, and $775,000 for 1,500,000,000 kilowatt-hours of secondary energy.

In the next half century, $361,000,000 will be received from sale of power at the present rates at Boulder Dam, creating a surplus of $166,500,000 after repaying with interest the cost of the dam and power plant. Arizona and Nevada each will receive $31,200,000 of this surplus as payment in lieu of the right to tax the property. The remaining $104,000,000 will be used by the Government as follows: $37,500,000 will go to repay with 4 percent interest an allotment of $25,000,000 of the cost of the project which is allocated to flood control; and $66,500,000 will be used as Congress directs in further development within the Colorado River Basin.

What Boulder Dam is to the Southwest, Kennett Dam will be to the Central Valley of California, Grand Coulee Dam will be to the Northwest, and Seminoe Dam to its vicinity in Wyoming. Kennett Dam will supply between 330,000 and 400,000 horsepower to the northern California power market, while regulating the Sacramento River and performing a most important function in a geographical redistribution of the waters of central California. Seminoe Dam will store the water of the North Platte River for use on the Casper-Alcova project, meanwhile generating 42,000 horsepower for its electrification.

The ultimate development at Grand Coulee will include a power house rated at 2,500,000 horsepower, and will serve as the keystone of the plan for complete development of the Columbia River and of the Columbia Basin irrigation project. It will create homes for almost half a million people where none now exist.

The primary work of the Bureau of Reclamation is and always will be the development of irrigation water supplies and the creation of new homes and communities in the arid West. But our projects are growing increasingly complex. The storage dam of the future, like Boulder Dam, will control entire rivers, and it must be made to serve all conservation purposes, prominent among which will be flood control, river regulation for irrigation and domestic uses, improvement of navigation and power generation.

In planning new projects, we must deal not only with present needs, but also with the economic problems of the future. Present developments must not conflict with future needs. Undertakings of the Bureau of Reclamation, therefore, must be based not only on adequate engineering plans and designs, but in addition on searching economic reports and investigations.

Where it is possible to develop power in connection with irrigation improvements, power must be considered. With water as scarce as it is in the West, it is important that what water we have does double duty.

Power Generation at Boulder Dam

The initial installation of generating equipment at the Boulder Dam power plant has been completed.

Four generators, each of 82,500 kilovolt-ampere capacity, larger than any others in the world, have been installed, tested and placed in operation on the line serving the City of Los Angeles. All of these units are in the Nevada wing in the huge horseshoe-shaped power-house, which lies in the bottom of Black Canyon at the toe of Boulder Dam.

Installation will begin immediately on the generators and turbines for units N–5 and N–6, which will produce power for the Metropolitan Water District of Southern California. These generators will also be of 82,500 kilovolt-ampere capacity. Plans and specifications are being prepared for two or more of these big units to be installed in positions A–6 and A–7 in the Arizona wing for the generation of power for the Southern California Edison Co. These units are expected to be ready for operation by the summer of 1939. A 40,000 kilovolt-ampere unit has been installed in position no. 8 in the Arizona wing of the power plant.

When the Boulder Dam power plant is fully equipped, it will contain 15 large units and 2 smaller units with a total capacity of 1,835,000 horsepower or 4,330,000,000 kilowatt-hours annually.

The four large generators already installed cost at the factory a total of $2,620,001, while the four 115,000 horsepower turbines, which are parts of the units, cost $1,091,309. Each unit, with the cost of installation, and the necessary controls, switching equipment, etc., cost approximately $2,240,000, or a total for the initial installation of $8,960,000. Two of the generators were manufactured and installed by the General Electric Co. and two by Westinghouse Electric & Manufacturing Co. The turbines were manufactured by the Allis-Chalmers Manufacturing Co. and were installed by the Bureau of Reclamation.

Installation of generating equipment was begun October 11, 1935. Generator N–2 was the first to be completed, and on September 28, 1936, it was run for the first time. On October 9, 1936, at 7:36 p. m., the circuits from the Boulder power plant to Los Angeles were closed and the first power transmitted. Regular service was inaugurated October 22, 1936. The second generator completed, N–4, was first run on October 24, and placed in regular operation December 1, 1936. The third unit, N–1, began operations December 16, and went into regular service December 28. The last unit to be completed was N–3, which made its first test run on February 12.

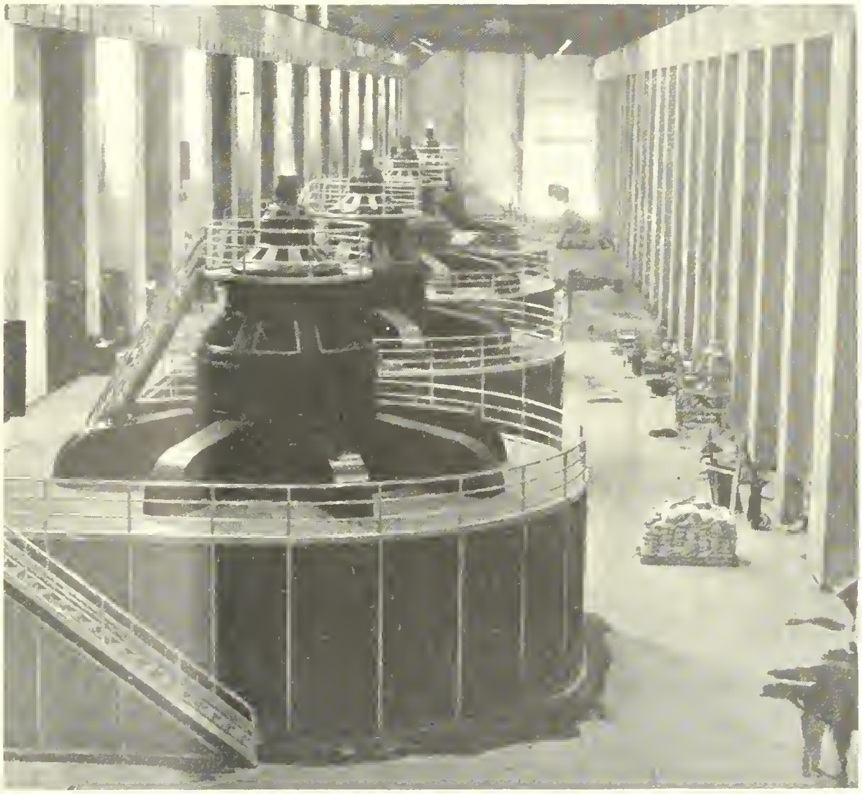
Power production has grown from 6,125,444 kilowatt-hours in October, when only unit N–2 was in operation, and it for only a few days, to 80,798,000 kilowatt-

hours in January, when units N-1, N-2, and N-4 were operating.

The peak load during the period of generation so far has been 162,000 kilowatts. This peak is the combined capacity of the three generators at the present head in Lake Mead, which is only partly filled. Each generator is at present capable of producing only about 54,000 kilowatts, but when the lake is filled to the normal operating level, the additional pressure developed will make each generator capable of producing 82,500 kilowatts.

The power is transmitted to Los Angeles over two 60-cycle 3-phase circuits, each 266 miles long. These transmission lines were built by the city of Los Angeles. They will carry a voltage on the sending end of 287,000 volts, the highest voltage for which any transmission line has been constructed in this country.

Assuming that sufficient water will be available for production of firm power on and after June 1, it is estimated that the returns from the sale of power during 1937 will exceed $1,500,000.



INITIAL INSTALLATION AT BOULDER DAM

Growth of Lake Mead

Lake Mead, the world's largest man-made body of water, which was created in the deserts of Arizona and Nevada by construction of Boulder Dam, again is growing.

Each day it is getting bigger and better and it is about to attain its first 100 miles in length as it traps water running off the mountains in the spring.

Ten million acre-feet of water, enough to cover the States of Massachusetts, Connecticut, and Rhode Island to a depth of a foot with more than enough left over to put 12 inches on Delaware now is impounded in this scenic reservoir.

John C. Page, Commissioner of Reclamation in announcing the growth of Lake Mead, stated that indications are enough water will be caught and stored by Boulder Dam this spring to put the operations of the Boulder Dam power plant on a firm or continuous power basis in June.

At the end of March 1936, Lake Mead held but 3,500,000 acre-feet of water. An additional 6,500,000 acre-feet has been caught and stored in Lake Mead in 12 months. This amount represents water surplus to the needs of the irrigators downstream from Boulder Dam, water which would have been wasted to flow unused into the Gulf of California had not Boulder Dam been constructed.

The approach of spring in the vast watershed of the Colorado River has increased the flow of the stream to the point where now each day several thousand acre-feet in excess of that which is by-passed through the Boulder Dam power plant to irrigators in Arizona and southern California is being added to the storage in Lake Mead.

Lake Mead now is 98 miles long and covers 67,500 acres. Its placid waters have opened to easy approach by tourists magnificent canyons which until 2 years ago could be entered only at peril to life and limb.

The flow of the Colorado River will increase gradually until the spring flood arrives late in May. The normal annual flow of the stream is in excess of 17,000,000 acre-feet. Most of this water comes rolling down the river in the spring flood. The run-off from July to March could be handled by a creek and is far too small and unreliable adequately to serve the irrigation farmers along the course of the river. Below Boulder Dam the river has been regulated so that ample water flows the year around.

Early indications this year are that the run-off of the river will be somewhat less than normal proportions. There is every indication, however, that the flow will be large enough to fill Lake Mead to the point where the power plant at Boulder Dam can be placed on a firm power basis. When this is done, the revenue from the sale of power at the plant will be greatly increased. The power now is being sold at the dump or secondary power rate of one-half mill per kilowatt-hour, measured in falling water. The firm power rate is 1.63 mills.

THE storage in Lake Mead above Boulder Dam reached 10,000,000 acre-feet on April 3, which is approximately one-third the capacity of the reservoir. The lake is now 98 miles in length, with a surface area of 67,500 acres.

Boulder Dam, a Work of Art

Boulder Dam is something more than a vast utilitarian device, a super-gadget. Enchanted by its clean functional lines and at the same time awed by its colossal size, you might be tempted to call it a work of art; as if something that began with utility and civil engineering ended somewhat in the neighborhood of Beethoven's Ninth Symphony. There is no doubt whatever that it is a thing of beauty, and that the impression it makes on any sensitive observer is not unlike that made by a massive work of art. But if you feel that language is being abused here, and hold that nothing so impersonal as a dam can be a genuine work of art, then you have to find some new way of accurately describing this new creation.—*From Article "Arizona Desert" by J. B. Priestley, in Harper's Magazine, March 1937.*

Towers Used on Topographic Survey of the Marshall Ford Reservoir Site, Colorado River Project, Texas

THE general plan for the "High" dam at the Marshall Ford site calls for an elevation of 748 as the top of the completed structure, making a total height above stream bed of about 265 feet. The reservoir of the "High" dam to this elevation contains approximately 50,000 acres. Of this acreage only about 40 percent is in open country. The remaining 60 percent, besides being quite rough and hilly, is covered with dense growths of cedar and post oak.

Plane-table topography to a scale of 500 feet to the inch with 10-foot contour intervals was desired. Horizontal and vertical controls for the topographic sheets were tied to the United States Coast and Geodetic Survey triangulation.

The plane-table work progressed rapidly in open country and to a certain extent in the lightly timbered sections, especially on steep hillsides bordering cleared valleys. However, in the more heavily timbered localities, it was not feasible to work from the ground even though a 15-foot stadia board was used and the rodman would "boot the rod" from the tops of the surrounding trees. Consequently, a tower that would also raise the topographer above the trees was built and put in use for these areas.

The tower finally adopted is portable, 22 feet 6 inches in height with a base 2 feet 6 inches wide, and a 5-foot square working platform. The base is built in two sections, 11 feet 0 inches and 11 feet 6 inches. The platform is in one piece, hinged in the middle for convenience in handling, and has a 1.5- by 1.5-foot opening in the center to provide access from below. The topographer climbs up the center of the tower and through the opening, closing a trap door after he is on the platform. Guard railing is in four sections constructed with 2- by 2-inch posts and 1- by 3-inch railing. Two coats of orange house paint are applied before the tower is sent to the field.


TAKING TOPOGRAPHY IN THE MARSHALL FORD RESERVOIR SITE. NOTE THICK UNDERGROWTH OF CEDAR

One 16-foot tower was built as an experiment, but as this, in general, proved to be too low, the higher tower was chosen. Five such structures at a contract cost of $51.50 each were built and are now in use on the project.

TOWERS EASILY MOVED

The towers are very easily moved where roads or trails provide access to the country. In such areas they can be dismantled, loaded on a truck or pick-up, and hauled to the new site in a relatively short time. There, the two sections of the base are bolted together and raised to position over the set-up. Light guy ropes previously attached to the four corners near the top hold the structure rigidly in place. Next, the platform is hoisted up and set by means of J bolts bolted through the flooring to the base. The railing is assembled and attached to the platform by means of hinge hasps in each corner. To facilitate erection of the base, provided the pick-up can be driven to the site, a rope is attached near the top, and tied to the pick-up. The top is then lifted as high off the ground as possible and with this as a start the car pulls the tower to its vertical position. In general, three men are required to move the tower, although two men could probably handle the job. Actual erection time at the new set-up is about 30 minutes.

In some places it has been necessary to cut roads to a new location. In other areas, due to the thick undergrowth, it has even been necessary to carry the tower in by hand. The latter method is not as slow as would appear since the two tower sections weigh only 120 pounds each, and the platform and railing combined weigh about 110 pounds.

Needless to say, the topographical work has been greatly expedited by use of the towers. The topographer has a much greater range of vision; he is able to direct the rodmen to openings in the timber; he is able to pick out future set-ups; and, in general, obtains a much clearer picture of the terrain. A further advantage is that very little clearing is necessary other than that required for control traverse lines. It is estimated that the towers will be in use on 30 percent of the total acreage, and that through their use, 25 percent of the time required for the entire survey will be saved.

Nine plane-table parties on this work showed an average for November of 900 acres to each party.

THE STATE of Oregon has appropriated $3,000 for experimental and demonstration work, including especially strawberry clover, in Malheur County. The Sioux City Seed Co. is establishing a 15-acre experimental farm near Ontario.

Progress of Investigations of Projects

Blue River transmountain, Colorado.—Horizontal and vertical control were established for a reservoir site located on the South Platte River between Platte Canyon and the Forks. This reservoir would be used to store Blue River water in winter, to cut down the size of Continental Divide tunnel, to permit the production of a maximum amount of power, and would be a substitute for the Denver Reservoir with a dam at the Forks.

Colorado-Big Thompson, transmountain diversion, Colorado.—The report on the economic survey of the project was nearly completed. Hydrographs showing the daily discharges of the Colorado River at Glenwood Springs and Palisade and the effects thereon of Granby Reservoir and Green Mountain Reservoir operations have been completed.

Eastern slope, Colorado. (*a*) *Cherry Creek Surveys.*—Topographic surveys were completed on the area in the vicinity of the old washed-out Castlewood Dam and along the stream bed for approximately 1 mile below, thereby finishing the topography in connection with the reservoirs and dam sites. Topographic surveys were begun on the Cherry Creek Valley below the Arapahoe diversion.

(*b*) *Trinidad irrigation and flood control.*—All topographic surveys were completed of the reservoir site on the Purgatoire River and its side canyons.

(*c*) *Hugo irrigation and flood control* —All topographic surveys have been completed of the reservoir sites and their connecting canal.

(*d*) *North Republican River.*—Topographic surveys were in progress on reservoir sites about 3 and 7 miles southwest of Wray respectively.

(*e*) *South Republican River.*—Field surveys have been completed for a diversion canal from Landsman Creek (formerly reported as Launchman Creek) to the proposed Ragan Reservoir site about 5 miles northwest of Burlington.

(*f*) *Badito irrigation and flood control.*—Topographic surveys were initiated and completed during the month, for a reservoir and dam site on the Huerfano River immediately above Badito.

(*g*) *Huerfano Canyon irrigation and flood control.*—Topographic surveys were begun on a reservoir site located on the Huerfano River in the vicinity of Mustang, Colo.

(*h*) *Cucharas silt survey.*—A silt survey was begun of the Cucharas Reservoir located on the Cucharas River about 15 miles northeast of Walsenburg.

(*i*) *Water supply.*—Rainfall run-off studies were initiated during the month for the area covered by the Eastern slope surveys and more particularly that portion in the vicinity of the Hugo irrigation and flood-control project.

Western slope, Colorado—(*a*) *Mancos Valley project.*—Water-supply studies on this project were completed during the month. The storable flows at the Jackson Gulch and Weber Reservoir sites were computed for projects of 10,000 and 13,000 acres.

(*b*) *Paonia project.*—Lateral lines were plotted and land classifications itemized on some of the ditches. Rating curves were plotted.

(*c*) *Silt project.*—The 6380 contour was run out north of Harvey Gay Reservoir, and arable areas above and below this elevation determined.

(*d*) *West Divide Creek project.*—The Owen Creek Canal location and a layout of the proposed Plateau Creek Canal heading were plotted.

(*e*) *Yampa reservoirs.*—The report for this project has been completed.

Rio Grande Basin, Colorado-New Mexico—(*a*) *Conejos dam site.*—Surveys of the reservoir, dam site, and feeder canal on the Mogote Reservoir were completed during the month. Diamond drilling was resumed on the Conejos dam site no. 1 and completed during the month.

(*b*) *Lower San Juan Valley.*—All previous reports and investigations of irrigation possibilities on the lower San Juan were reviewed.

(*c*) *San Juan-Chama diversion.*—The operation studies of terminal storage were worked out on the basis of final water-supply figures.

(*d*) *San Juan-Rio Grande diversion.*—All basic data regarding this feature were assembled.

(*e*) *State-line dam site.*—Two survey crews were sent into the field to resume work on the reservoir area. A reconnaissance of the canyon area between the State line and the mouth of the Rio Colorado was made.

Boise (Boise-Weiser-Payette), Idaho—Mountain home land classification.—Three plane-table parties were surveying and classifying land. During the month 47, 000 acres were mapped, bringing the total to 85,000 acres.

Canal location along Payette River.—Strip topography was taken from Banks toward Horseshoe Bend, completing the topography to the site of the eastern tunnel inlet of the Horseshoe Bend—Dry Creek tunnel—and topography was begun on another site for a tunnel inlet.

Canal location from Boise diversion dam to Dry Creek.—One plane-table party was at work completing strip topography along the canal line and extending the control line along the South side of Dry Creek.

Gallatin Valley, Mont.—No field work was done during the month, except stream measurements on the Gallatin River.

Saco Divide, Mont.—Studies and estimates were completed for the pumping plant. These estimates include costs of pumping by both natural gas and electricity.

Conchas project, New Mexico.—During the month 19 miles of main canal, 3 miles of alternate traverse, and 22 miles of cross-sections and profile were completed. Twenty-five miles of flag line and fifteen miles of check levels were run, preparatory to canal location. Following the alinement, test pits were dug at about 1,000-foot intervals. Final location was determined for tunnel no. 2. Detail topography was taken and a spillway site selected just below tunnel no. 2. A land-classification party has been following up the final location. Diamond drilling was begun on tunnel no. 1 and completed at a depth of 94 feet, showing all shale.

Deschutes, Oreg.—Preparation of the report on the Waldo Lake diversion was continued. Work was begun on the review and revision of the reports on the Plainview and South Unit projects. Preliminary designs and estimates were begun for an earth-fill type dam to be located about 37 miles northwest of Bend, Oreg., at the Suttle Lake dam site.

Black Hills, S. Dak.—A small amount of work is in progress, as weather permits.

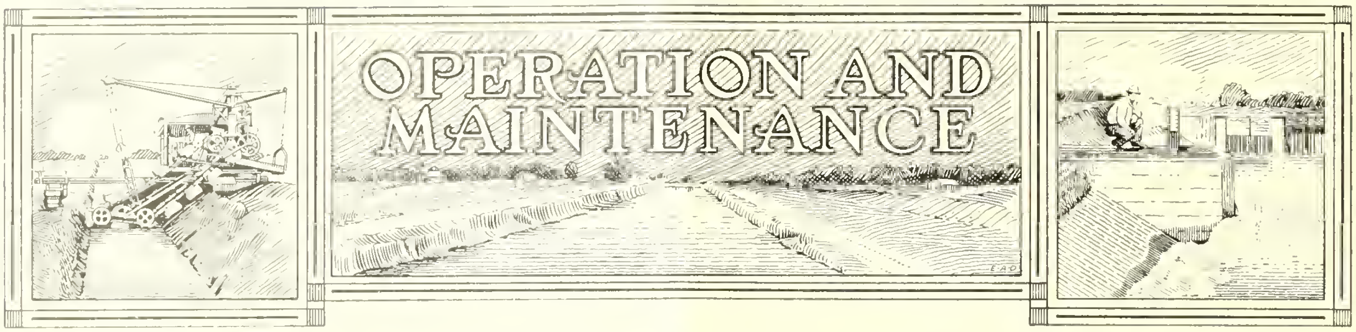
(a) *Angostura project.*—Additional surveys are in progress.

(b) *Rapid City project.*—Arrangements were made to obtain water-consumption records for the 1937 irrigation season for the Rapid Valley canals. Estimates of costs were made for several different sizes of hydro-electric power developments at the Pactola dam site.

Utah investigations.—(*a*) *Salt Lake Metropolitan Water District aqueduct.*—Report on the investigations was forwarded to the Denver office.

(*b*) *Dixie project investigations.*—Preparation of report on the water-supply investigations of the Virgin River was completed.

Colorado River Basin.—Areas adjacent to Green River, Utah, were classified during the month and classification begun of the lands in the East Paradox Valley.



Farming Widens Its Scope

PROFITABLE agriculture is predicated on a number of factors. Modern agriculture demands the most efficient coordination of its various practices, in terms of individual farming units, and also the broadest possible adaptation of its output to fit the needs of a highly industrialized society.

The difference between loss and profit in agriculture, as in all other types of production, is often measured by the degree of efficiency with which various operations are conducted and the manner in which the products of the farm lend themselves to consumer demand, various trade practices, and other factors. The farmer of today is not merely a tiller of the soil. He has to be an expert in feeding. He has to know how to meet nutrition problems. He has to be an engineer with experience in mechanics as applied to agriculture. In California the farmer must have knowledge of irrigation practices. He must know something of the manner in which his raw materials are processed into finished products and consumption goods. He must know all these things and much more. That is the reason why the California Agricultural Experiment Station long ago broadened its scope of research, placing emphasis upon problems of management and utilization, as well as upon plant and animal breeding, conservation of natural resources, and protection against pests and diseases.

EFFICIENCY IN IRRIGATION

Much of the agricultural output of California is produced under irrigation. There are, of course, exceptions here and there, but, broadly speaking, agriculture in California is synonymous with irrigation. Water is quite as important as soil in this State, and its conservation is just as important as the conservation of the soil resources of the State. For maximum results, the best irrigation practices must be coordinated with most desirable cultural practices and use of fertilizers, as well as with the adaptation of crops most suitable to certain types of soils.

Growth of deciduous fruit trees and vines is affected only when moisture in that portion of the soil which contains the greater part of the roots has been reduced to a content known as the permanent wilting percentage.[1] This conclusion is a result of many years of experiments with peach and prune trees at the branch of the college of agriculture at Davis and in the typical fruit-growing sections of the State. At first, experiments conducted in other States seemed to indicate that pear trees were an exception to this generl rule. Three years of investigations with pear trees in California, however, have given results which are in agreement with this principle of irrigation.

The fact that growth and yields of deciduous fruit trees and vines will not be affected adversely until the moisture supply is reduced to the permanent wilting percentage is an extremely important and practical finding. The saving that results from the withholding of water until it is actually needed by the plants often reduces materially the cost of operation and production. In many sections of the State, irrigation water is applied very early during the growing season when the soil is well supplied with readily available moisture. Adding water to the soil at this time will neither force the growth of the plant nor of the fruit.

Studies of irrigation of deciduous fruit trees disclose no evidence that they acquired more drought resistance when subjected to repeated wilting, or where the soil remained dry for long periods during the growing season. When the soil-moisture supply was replenished, the trees behaved precisely the same as those which had not been permitted to wilt.

IRRIGATION OF GRAPES

Wine made from grapes of Muscat and Carignane varieties showed no marked differences in quality which might be attributed to irrigation treatments of vines. These tests with wine grapes have been carried on for only 1 year, but they are in line with the findings of irrigation experiments with table grapes.[2]

A deficiency of readily available water, that is, a soil-moisture supply reduced to the permanent wilting percentage in the top 4 or 5 feet of soil, is evidenced by the dropping of a considerable portion of the foliage from the vines. When this occurs during warm weather, many of the berries become sunburned, and the grape crop is reduced materially. The undamaged berries on the dry vines, although smaller, contain approximately the same percentage of sugar at harvest time as those grown on plots supplied with readily available water. New cane growth is greatly reduced whenever the vines are allowed to remain wilted for several weeks during the growing season.

In observations conducted at the university farm at Davis, grapes showed evidence of lack of water when the top 4 or 5 feet of soil were dry, although there was wet soil at lower depths. These observations are surprising in view of the persistence of grapevines on hillsides or in other dry locations, a fact which has led to the belief that grapes might be classed with drought-enduring or drought-resistant plants. One of the characteristics of such plants is the ability to develop deep root systems.

SUGAR-BEET IRRIGATION

It has been held that sugar beets are extremely sensitive to fluctuations in soil moisture. Irrigation studies conducted for several years at the university farm at Davis show that sugar beets act substantially the same as deciduous fruits, vines, and other crops. When grown on the same kind of soil, sugar beets wilt at the same soil moisture content as do trees and vines. Beets do not wilt severely in high soil-moisture contents on hot days.

[1] Veihmeyer, F. J., and A. H. Hendrickson. 1932. Essentials of irrigation and cultivation of orchards. California Agr. Ext. Cir. 50: 1–24. Revised ed.

[2] Hendrickson, A. H., and F. J. Veihmeyer, 1931. Irrigation experiments with grapes. Amer. Soc. Hort. Sci. Proc. 28: 151–57.

The growth, yield, and sugar content of beets were not significantly different on experimental plots which received extremes in irrigation treatment. Plants given infrequent applications of water grew at the same rate as those which were irrigated frequently. The unirrigated plants grew at the same rate as those on the irrigated experimental plots until the moisture in the top 4 feet of soil was reduced to the permanent wilting percentage.

Before the beets were half grown, the roots were able to extract all of the readily available water to a depth of 4 feet in Yolo clay loam. Then, they wilted. After the beets were more than half grown, they were able to deplete the soil-moisture supply to a depth of about 5 feet, after which wilting occurred. The depth of rooting of sugar beets at the university farm at Davis seems to be limited to 6 feet.

Growers have often held the opinion that the sugar content of beets at harvest is approximately the same irrespective of the drastic differences in soil moisture during the growing season. Experiments conducted by the California Agricultural Experiment Station do not bear this out. Measurements of the sugar content, made at intervals during the growing season, showed no significant differences due to irrigation treatments, except where the plants were permitted to remain in a wilted condition for approximately a month before irrigating. During the period in which the beets were wilted, the sugar content increased from 3 to 5 percent over that of nonwilted beets. Within a week after irrigation, however, the sugar content of the revived plants was restored to approximately the same amount as in the nonwilted beets.

SUGAR-BEET SEEDBED PREPARATION

The merits of ridge and flat plantings of sugar beets have already been discussed. Experiments with beets now indicate that intensive soil cultivation for seedbed preparation is not necessary for sugar-beet culture. Where cultivation has been practiced under unfavorable soil-moisture conditions, however, the penetration of irrigation water may be very seriously affected in many cases. The direct saving in labor and energy by the reduction of cultivation for sugar beets is important. In one series of test plots, the soil was plowed to a depth of 12 inches, and subsequently disked and harrowed to produce a fine seedbed. In another series of test plots, the soil was stirred only to a very shallow depth so as to obtain enough loose soil to cover the seeds. After the beets were planted, all cultural operations were identical in all plots.

In the carefully prepared seedbeds, the yields last year were 28.4 tons to the acre. In the unplowed plots, the yields were 28.7 tons to the acre. The sugar content of the beets in both series of plots was the same. These tests take issue with another widely held opinion. Contrary to the general belief, the shape of the beet root is not affected by deeply plowing the soil previous to planting. In the tests at Davis, the beets developed as readily in the undisturbed Yolo clay loam as they did in the loosened soil.

IRRIGATION OF TOMATOES

For several years, irrigation experiments with tomatoes, comparable with those with sugar beets, have been conducted at the university farm at Davis. In these experiments, widely different soil-moisture conditions were maintained in three series of test plots. In one, the frequency of irrigation was such as to maintain the moisture content of the soil at a high level. In the second, water was applied only when the soil moisture was reduced to the permanent wilting percentage, and the plants began to wilt. In the third series of plots, no irrigation was applied.

In 1935, the first series of plots yielded 28.1 tons to the acre; the second, 28.5 tons; and the third, 17.7 tons. Frequent irrigations, which maintained the soil moisture at a high level, did not produce more tomatoes than irrigations applied only when the soil was dried to the permanent wilting percentage. Furthermore the number of tomatoes per vine was about the same irrespective of the irrigation treatment. Application of water did not cause the blossoms to drop.

Frequently growers hesitate to irrigate lest the yield be decreased through the dropping of blossoms. On sandier soils, or those having a lesser amount of readily available water than the soils at Davis, drought conditions earlier in the growing season may cause the dropping of leaves and blossoms, as well as fruit, as a result of wilting. Studies of the root distribution of tomato plants show that the rate of growth of unirrigated tomatoes is not noticeably different from that of irrigated plants, until the moisture content of the top 7 feet of Yolo clay loam is reduced to the permanent wilting percentage. Some extraction of moisture by tomato plants occurs as deep as 11 feet, which indicates that tomatoes are deep rooted.

EFFECTS OF SOIL MOISTURE ON ORANGES

Experimental work in the irrigation of citrus fruits has been conducted for many years at the citrus experiment station at Riverside. The projects have been of a long-time character. During the past biennium, differential irrigation practices have been tested out on a 10-acre tract of 6-year-old Washington navel orange trees growing on Ramona sandy loam soil. The season 1935–36 is the third crop season in which these experiments have been conducted. They were designed to show not only the effect upon trees and crops, of wide variations in soil-moisture percentage, but also the effect of applying water to varying percentages of the soil in which the roots normally grow.

To date no significant differences are shown in the percentage of fruit drop between trees irrigated on a 15-day schedule and those irrigated at intervals of 30 days. Marked differences, however, in the cross-sectional area of tree trunks have resulted by varying the amounts of soil moisture; for example, in plots where 60 and 80 percent of the soil between the rows is wet, the trees are larger than those in soils containing less moisture. Where only 40 percent of the soil is wet, or where irrigation is given in alternate centers or on one side of the tree row only, the trees are smaller in diameter. Variations in irrigation do not seem to have any bearing on the sugar-acid ratio or the percentage of juice of the fruit.

INTERNAL DECLINE OF LEMONS AS AFFECTED BY IRRIGATION

Studies have been conducted at Riverside to determine the effects of irrigation on internal decline of lemons. In these tests specially selected trees were grown in lysimeter tanks 10 feet in diameter and 4½ feet deep. The trees were treated alike until their tendency toward the production of declined fruits had been determined. Then they were grouped into three lots.

One lot was given a minimum amount of water; the second, an intermediate amount; and the third, a still larger amount. The amounts of water applied were based on moisture equivalents and permanent wilting percentages. Over a period of 4 years such treatment caused no visible damage to any of the trees. The trees receiving the intermediate amount of water produced the most fruit and had the least amount of decline. Those receiving the least amount of water not only produced the least amount of fruit but also the greatest amount of decline.—*From Partners in Agricultural Progress, the biennial report of the University of California, College of Agriculture.*

Alfalfa Fertilization Tests in Yuma County

By G. E. Blackledge, County Agricultural Agent

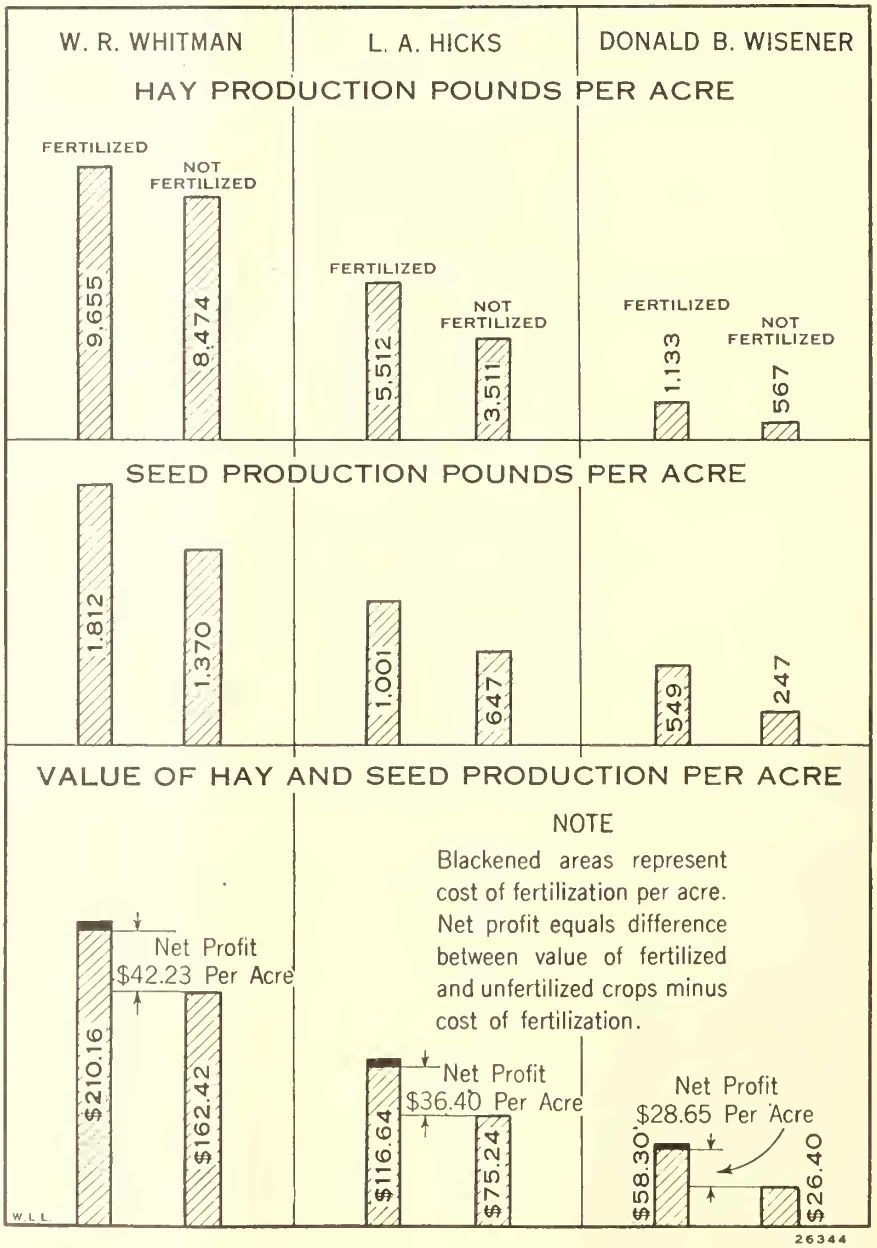
DURING the past 2 years three alfalfa fertilization test demonstrations have been conducted in Yuma County. These demonstrations have given consistent results. One test is now complete for a 2-year period. This test was on the W. R. Whitman ranch in the South Gila Valley several miles east of the Yuma project and consisted of nine 2½-acre borders, using ammonium phosphate 11:48 at the rate of 167 pounds per acre and superphosphate 18 percent at the rate of 333 pounds per acre, making three replications of each fertilizer and check. The superphosphate plots had produced the highest yields of hay and seed at the end of the first year but the final conclusion at the end of the second crop year shows that the ammonium phosphate applications gave by far the most economical results. With an application of 167 pounds per acre of ammonium phosphate a yield of 9,655 pounds of hay was made compared to 8,474 pounds of hay on the unfertilized borders, thus making an increase of 1,181 pounds of hay in the 2 years. The ammonium phosphate plots averaged 1,812 pounds of alfalfa seed compared with 1,370 pounds of seed per acre on the check plots which received no fertilizer, thus making an increase of 442 pounds of seed per acre during the 2 years. The value of these increased products due to the 167 pounds of ammonium phosphate per acre is estimated to be $47.34. This estimated value is figured on the basis of 1,181 pounds of additional hay at $6 per ton and 442 pounds of alfalfa seed at 10 cents per pound. The cost of the fertilizer application is $5.51 per acre. This makes the net value of the increased products $47.34 per acre, leaving a net profit for the practice of $41.83 per acre.

Another demonstration carried on by Mr. L. A. Hicks in the Mohawk Valley, some 40 miles east of Yuma, showed even more outstanding results for alfalfa fertilization than did the test carried on in the South Gila Valley. This demonstration has been carried only 1 year. The carefully kept records of Mr. Hicks show an increase of 354 pounds of seed and 2,001 pounds of hay from an application of 150 pounds of ammonium phosphate. A conservative estimate of the value of the increased hay and seed due to the ammonium phosphate application of 150 pounds per acre is $41.40 per acre. The cost of fertilization per acre in Mr. Hick's demonstration is $5.00, thus leaving a net profit of $36.40 for the practice.

A third demonstration was carried on in the valley division of the Yuma project in cooperation with Mr. Donald B. Wisener where phosphate fertilization again showed outstanding results. This demonstration consisted of 20 1-acre borders. There were three types of fertilizers used with one check to each series. Five replications were made. The first growth of hay after fertilization showed marked results for the fertilizer applications but the results were not measured since the hay was pastured off by sheep. The second cutting of hay then was the first record taken from this demonstration.

The check plots averaged 247 pounds of seed per acre while the ammonium phosphate 11:48 plots averaged 549 pounds per acre, making an increase of 302 pounds of seed per acre. The cost of the application of ammonium phosphate in this particular demonstration amounted to $6.50 per acre and was designed for a 2-year program. Mr. Wisener applied 100 pounds per acre on the rest of his acreage and claims that he got the same response on this year's seed crop as was obtained from the 200-pound application in the demonstration plots. From this line of reasoning it may be estimated that Mr. Wisener established a net profit of $26.95 per acre on his 1936 seed crop by adopting this practice.

While these tests indicate that phosphate fertilization is the answer to the problem of maintaining our alfalfa seed

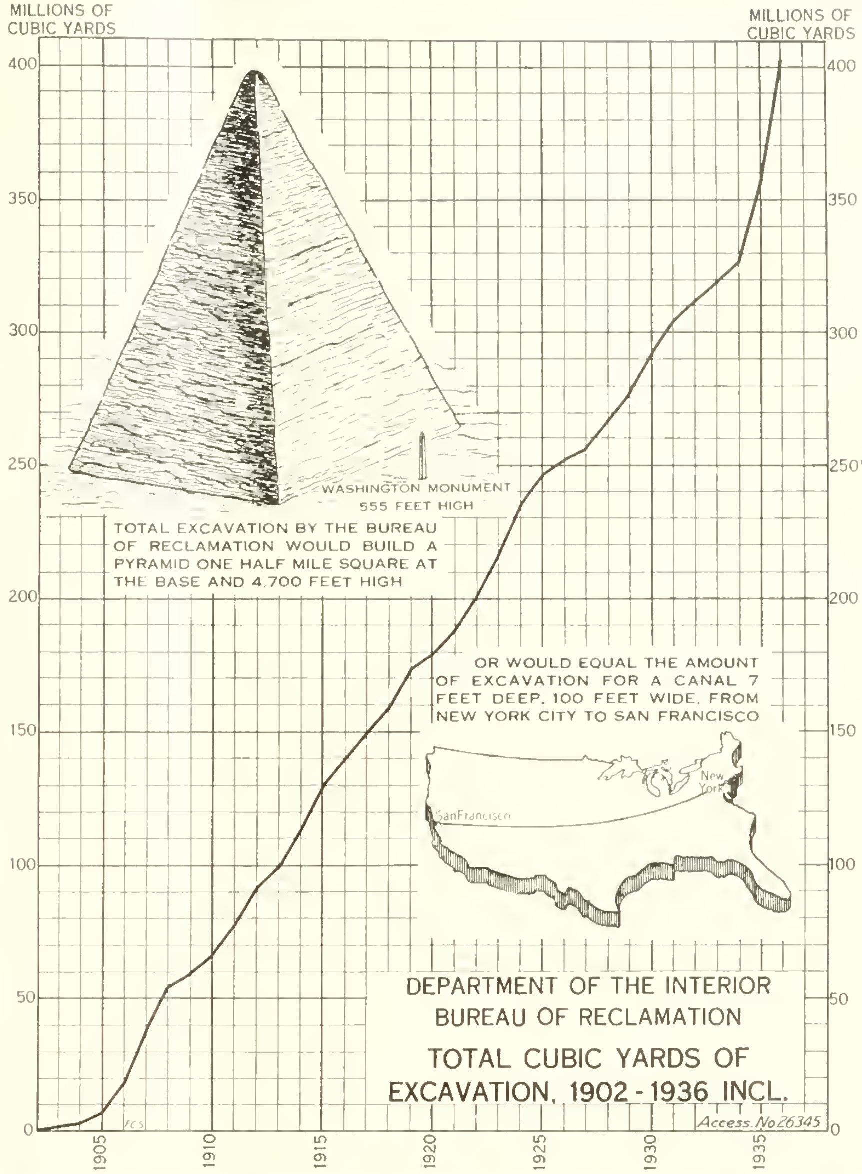


and hay yields, it must not be assumed that all soils are deficient in available phosphate and that all alfalfa fields will show the same response to phosphate fertilization as has been shown in these tests. Perhaps the soundest practice for any farmer who is contemplating the application of phosphate fertilizer on his alfalfa fields is to carry on tests similar to the ones just discussed. Chemical analysis of the soil gives some degree of indication as to the needs of the soil but field tests are much more accurate.

Excavation by the Bureau of Reclamation

Since the Bureau of Reclamation was organized, in July 1902, there has been excavated in connection with the construction of the Federal irrigation projects over 400,000,000 cubic yards of material of all classes, including earth, indurated material, and rock.

The chart indicates the annual increase in the amount of excavation, and it will be noted that in the last fiscal year there was excavated about 46,000,000 cubic yards. A very large part of this was in connection with the All-American Canal, from the Imperial Dam on the Colorado River to the Imperial Valley in Southern California, and for the Grand Coulee Dam on the Columbia River in Washington.



New Columbia Basin Map

The Bureau of Reclamation has issued map no. 26320 (1937), Columbia Basin Project (black and white), size 10½ by 15¾. Price 10 cents each.

Livestock Poisoned by Eating Water Hemlock

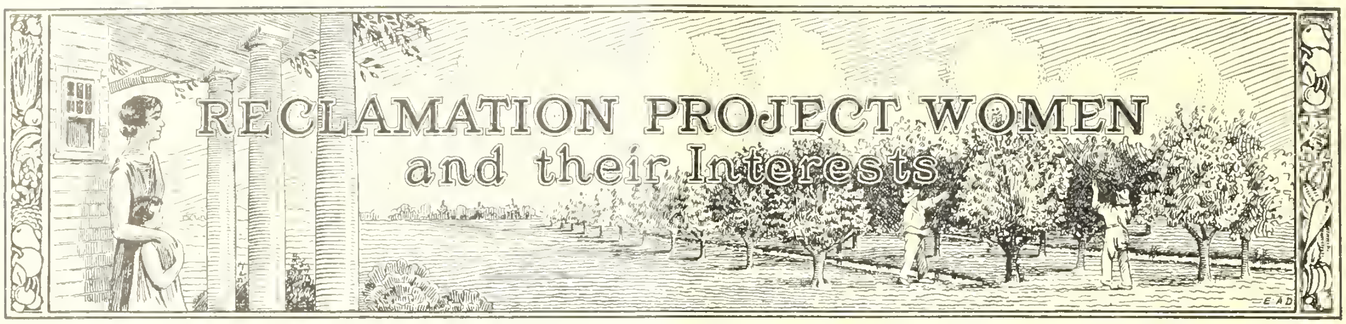
Farm animals—mostly cattle—often die in early spring after eating water hemlock which grows in swamps and wet meadows and is frequently abundant along irrigation ditches, warns A. B. Clawson, of the United States Bureau of Animal Industry. The plants, of which there are several species, are considered the most poisonous in the United States. The species common in the Eastern States is sometimes known as the spotted water hemlock. One which causes losses on the Pacific slope is called the tuber water hemlock. The different hemlocks are sometimes erroneously known as the wild parsnip.

Symptoms of water-hemlock poisoning in cattle are frothing at the mouth and violent convulsions which usually result in death within a short time. No effective remedy is known. The only means of prevention is to keep animals from eating the plants.

The plant usually may be identified by an examination of the rootstock and leaves. The poisonous species grow from rootstocks to which are attached roots that may be small, as with the tuber water hemlock, or may be thick, fleshy tubers as in the spotted water hemlock. The rootstock, cut open lengthwise, shows a number of transverse chambers, a characteristic which, however, occurs in a few other plants. The leaves are divided into leaflets, each of which is pointed and more or less saw-toothed along the edges. Branches of the leaf veins run toward the notches between the teeth.

Cattle in grazing eat off the top portions of the rootstocks, or the entire rootstocks that have been thrown out when cleaning ditches or that have been washed out by water from higher elevations. Only a small quantity of the rootstock may kill any animal that eats it. The tops of the plant probably are poisonous in early growth, but experimental feeding has shown conclusively that neither the tops nor seeds of mature plants cause losses.

Sometimes children are poisoned by eating the water hemlock roots. In such cases an emetic should be administered promptly. Recovery usually takes place if the remedy can be applied before the poison is absorbed by the patient.—*From the Utah Farmer, April 10, 1937.*



Interior Arrangement and Decoration of Farm Homes [1]

By Ellen Pennell, Homemaking Editor, "Country Home"

INSTEAD of telling you my opinions on interior arrangement and decoration of country homes, I am going to relay to you the wishes and expressions of rural homemakers from coast to coast. A home-building contest conducted by The Country Home this past spring brought replies from 931 women, telling exactly what they needed and wanted in a modern farm home.

These women are not so modest in their desires for improved homes. They want the latest and the best that is available in house building trends. Their only standard to go by is the new city or suburban home, or the model houses on display at fairs and such places. The progressive homemaker no longer thinks and speaks of building in terms of parlors, pantries, and porticos. She asks for a well-arranged smaller kitchen, with utility room near by. She wants a recreation room for entertainment, parties, and club meetings. She asks for an office for her husband (and he has given her this idea), a workshop for son, a room for daughter, and a sewing room for herself.

The dining room as such is up for question, even in the rural home. There are many comments favorable to the dining-living-room combination. With this arrangement some prefer a screened-in back porch for serving crowds in summer.

Air-conditioning systems are the subject of many inquiries from our readers.

In the expressions of many, the ideal house must include a basement, fruit and vegetable storage room, back stairs leading to basement and also up stairs, a back hall, a front hall, and an attic, along with the living rooms, bedrooms, and bathrooms. Materials come in for their share of importance. Insulation, weather stripping, fireproof shingles, and siding are a part of their farm vocabulary. Extreme heat and dust storms have doubtless sold much of this material.

MANAGER'S HOME WITH PERGOLA, WHITEHALL FARM, YELLOW SPRINGS, OHIO

DETAIL ON MODERN HOMES

There are endless details which homemakers request in the finished house, details that may seem petty, but they add much to the comfort of living. The height of equipment has long been a subject of discussion, to express it mildly. Kitchens will never be completely convenient until equipment is installed according to the height of the homemaker, instead of the height of the plumber or carpenter. The bending, stooping, reaching, and climbing on ladders because the local carpenter had to build according to his mentality has provided more hazards in homemaking and caused more accidents in kitchens than it makes me comfortable to relate. This says nothing of the inconvenience it lends to the daily housework routine.

As for this matter of cupboards, there are so many important details that frequently you may think them petty nuisances, but just the same they add to the ease of meal preparation.

Movable and adjustable shelves are favored. Some shelves should be narrower than others for small items. Wide shelves that hold two rows of articles, which necessitate reaching to the back row for a can of baking powder, always result in a general knocking down of several items that spill all over cupboards and work surfaces, thus making an extra clean-up job which invariably results in ill temper.

Wide articles require wide shelves and small articles require narrow shelves. Racks on cupboard doors will take care of many of the smallest items as salt and pepper, spices, and so on. Platters, trays, and pie, cake, and muffin tins fit neatly into upright partition units.

KITCHEN EQUIPMENT

There is another important question in the minds of every woman who really lives in her kitchen, and that is arrange-

[1] Presented before the Farm Structures Division at the winter meeting of the American Society of Agricultural Engineers, at Chicago, Ill., December 1936.

ment of major pieces of equipment. Since our utility companies have spent time and money building the most efficient kitchens planned by the best home economists and engineers in the country, it would be smart to consider their principles. They recommend that equipment be placed according to meal preparation procedures. This places equipment along two sides and one corner of the kitchen. First the refrigerator, followed by a cabinet with surface to be used in preliminary steps in preparing food, then sink and dishwashing center, and next the range with a serving table beside it. From this serving table, food may be carried directly to the dining room. This leaves the other side of the kitchen available for a breakfast table and even a desk if desired.

The equipment that furnishes this kitchen is a real item in the farm home. Every rural homemaker wants a good range, a refrigerator large enough to preserve quantities of food, adequate running water, and cupboard space, and all pieces running smoothly.

The first request from homemakers who were questioned when rural electricity came their way, was for a refrigerator. There were many eager for ranges.

Again I repeat that the desires of the rural women are not so modest when it comes to furnishing her home, but she doesn't stop merely with the interior. There is the landscaped lawn and the attractive doorway in her mind. So many women ask for ideas to attract guests to come in the front door. There is also a request for the back door to be placed in direct line with gardens and service area of the yard.

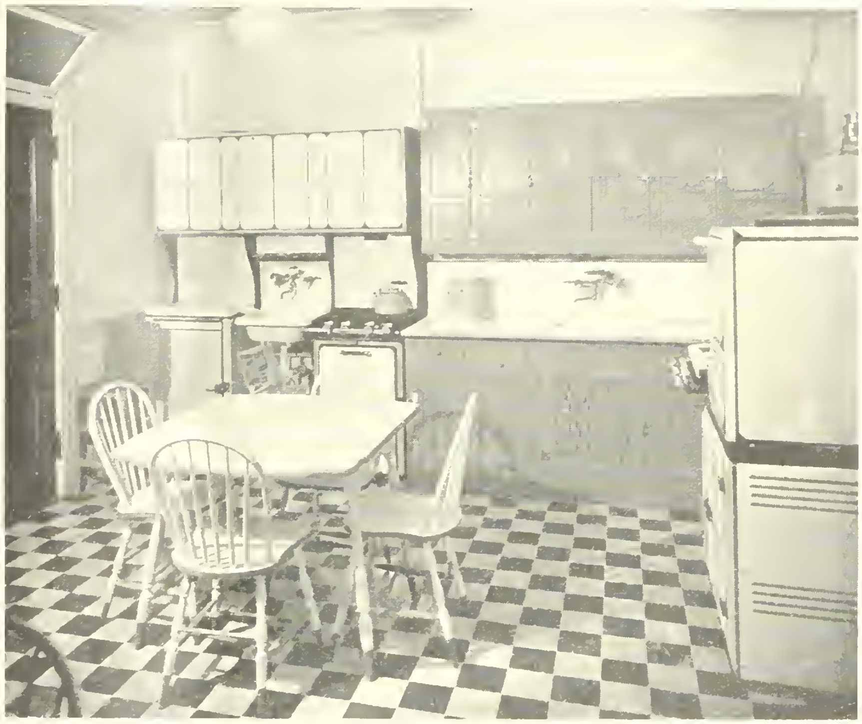
COOPERATION OF FARM WOMEN IN BUILDING

As for the decorative side of this problem, her wishes are direct and simple. She wants color, but color that will stay, color that stands cleaning. Painted surfaces are popular, linoleum floors are still favored in kitchen, bath, utility room, and sometimes in halls.

They do not ask for furniture that is elaborate, but it must be confortable, durable, and attractive, and it must be selected to please every member of the family. They realize that farm homes are lived in and used daily, so all decorative touches must be livable.

There is a real craving for color and beauty in the home, as evidenced by the use of too much of it in many cases. There must be light in the house. Light from color of the interior, and windows which permit light and a view from the exterior.

When considering houses, think of those who are going to build. There are many who have the money, and even more desire than money. All they need is encouragement and help. They cannot depend upon local carpenters and material dealers. Every agency must come to the rescue of the country home—you in your work, building companies in their fields, and editors in theirs. Remember if you will help and instruct, the farmer will build, and build well.



EXPERIMENTAL KITCHEN, FARMER SCHOOL OF COOKERY

The challenge is ours. If farm homes are not greatly improved within the next 10 years, it will not be the farmer's fault, but ours.—*Agricultural Engineering.*

Irrigation Slides Available for Fall Booking

In order to take care of the many requests for the slides "New Ideas in Irrigation Agriculture", two additional sets were made and these three sets are now on scheduled itineraries in various parts of the West.

One itinerary includes a series of farm meetings on irrigation projects in the Southwest. A second itinerary covers a program for 18 C. C. C. camps on irrigation projects from April 15 to September 15. A third itinerary is an extended tour of Wyoming under a coordinated program sponsored by the State Departments of Agriculture, Commerce and Industry, and the Extension Division of Wyoming University.

These colored slides, accompanied by a descriptive lecture, present improved methods for applying irrigation water, plans for use of waste land, and present practices in weed control and their practical application. The slides were made from photographs taken in the summer of 1936 by Bureau of Reclamation field men and show successful methods in use by irrigation farmers in various sections of the West.

Farm groups, agricultural schools, or any civic groups interested in irrigation may borrow these slides at any time they are available. A few dates are open for July and August, and booking may now be made for September and October. Request for the slides should be made to the Commissioner, Bureau of Reclamation, Washington, D. C.

S. H. Bober, Newell, S. Dak., seedman, sold a shipment of alfalfa seed, Dakota No. 12, to Russia to be used by experimental farms of that country where climatic conditions are similar. This seed originated in Butte County on the Seth Bullock ranch from what was probably the first alfalfa field in South Dakota.

PLANS are under way by the Yakima Growers Cooperative, Inc., to raise $50,000 by stock subscriptions to finance the construction of a cooperative cannery at Yakima. Money for the operation of the cannery will be obtained from the Spokane Bank for Cooperatives.

Safety in the Reclamation Civilian Conservation Corps Camps

By Clyde C. Beam, Assistant to the Supervising Engineer, E. C. W.

TWO features of the Civilian Conservation Corps which receive much attention from the public are the efficiency of the enrollees on work projects and the safety conditions under which they work. The past 4 years have proven their efficiency, as evidenced by the volume and character of the work accomplished, the present favorable attitude of the public, and the many requests of communities for the establishment of new camps.

The widespread publicity now given to any unusual event affecting the C. C. C. keeps the safety situation constantly before the public, and erroneous conclusions are possible. However, statistics compiled for the C. C. C. reveal that its accident rate compares favorably with industries doing similar work. This is gratifying when one realizes that enrollees in the C. C. C. are much younger and inexperienced than those in private industry, and that the turnover is much greater because the men enroll for 6-month periods.

The majority of new arrivals at C. C. C. camps are inexperienced in the use of machinery and often in the use of the most ordinary of tools. Consequently, they must be taught to use them safely and efficiently. Because of these factors, safety education will necessarily remain one of the most important features of training given the C. C. C. enrollees.

ORGANIZATION

The necessity for proper education and regulation in all matters pertaining to safety, in connection with the operation of the Civilian Conservation Corps, has led to the establishment of an organization within Emergency Conservation Work for that purpose.

In the office of the director, E. C. W., in Washington, D. C., there is a safety engineer who has general supervision over all safety matters for the C. C. C. camps and is chairman of the E. C. W. Safety Council. This organization, composed of representatives of each of the cooperating agencies, meets monthly to discuss safety data accumulated from the field, to formulate plans and regulations with intent to decrease accidents and fatalities, and to advise the safety engineer generally. In its Washington office each Government agency cooperating in E. C. W. has an organization for recording and consolidating the accident data received from the C. C. C. camps under its supervision, and for preparing and distributing to the camps such charts and analyses thought to be of value to them in improving safety conditions. The size and structure of these safety organizations in Washington differ greatly because of the variance in the number of camps allotted each agency.

In each C. C. C. camp there is a safety committee composed of the camp commander, the camp superintendent, and the camp doctor. This committee deals with individual safety problems in the camp and outlines programs for the camp safety meetings which are held every week, with all members of the camp attending. Each camp superintendent appoints a safety assistant, whose duty is to assist him in a personal and frequent inspection of all machinery, equipment, buildings, etc., to insure their safeness and to keep an adequate check on the safety conditions of the work in progress. Each camp also has a number of trained first-aid men, who are capable of administering first aid in the field in case of an accident.

ELIMINATION OF PHYSICAL HAZARDS

Every effort is being made to eliminate the mechanical and industrial hazards

DETAIL OF C. C. C. ENROLLEES LEAVING FOR WORK PROJECT. NOTE STEPS USED FOR LOADING, SEATING ARRANGEMENT, AND CLOSED TOOL BOXES

connected with C. C. C. work. All C. C. C. trucks are driven by experienced licensed drivers and are equipped with governors which limit the maximum speed of the truck to 35 miles per hour. Trucks are inspected daily by competent mechanics for mechanical defects, such as faulty brakes, faulty steering apparatus, and dangerous tires; all repairs and adjustments being made before the trucks are allowed to be returned to service. Tractors and machinery are kept in safe working condition by the camp mechanic. Small tools, such as shovels, picks, etc., are inspected each evening by the safety assistant and the foremen, and the dull and unsafe tools are segregated and left at the camp shop until they have been sharpened and repaired.

All work projects are carefully supervised for safety conditions and the most dangerous are especially studied and regulated to eliminate any hazards. Blasting is generally done under the supervision of a competent and thoroughly experienced blaster who usually loads and fires all shots using only electric blasting caps. All precautions such as testing the caps, warnings, signs, etc., are rigidly observed. Regulations for work in gravel pits provide for removal of all overburden and that a safe slope, 45° or flatter, be maintained at all times on the sides of the pits.

On all work such as hand drilling rock, using grinding wheels, breaking rocks, etc., where there is danger to the eyes from flying particles, enrollees are required to wear goggles complying with definite specifications which provide principally that the lenses must be of optical glass and case hardened to withstand the force of a ⅞-inch steel ball dropped 50 inches; and that eye cups must be of metal, with perforated metal side shield, joined by a flexible metal bridge. Those in close proximity to acetylene or electric welding must wear goggles with special lightproof lenses, as the light from welding is very injurious to eyesight. In general, every effort is made to provide the C. C. C. enrollees with safe and efficient working facilities in a thoroughly safe environment. It is a well-established fact that safety and efficiency go hand in hand.

MINIMIZING HUMAN HAZARDS

It is thoroughly recognized, by all concerned, that precautionary measures and diligent inspection on the part of the supervisory personnel are not sufficient or complete means of minimizing the number of accidents, as they cannot compensate in full for careless, slipshod methods and individual mannerisms of the enrollees. With this thought in mind, every effort is being made to induce the boys to become safety conscious. Safety consciousness in an enrollee embodies alertness, a recognition of hazardous conditions, common sense, an absence of horseplay, and, in general, a serious regard for the life and well-being of himself and others. To become safety conscious, one must primarily be able to recognize danger and then he must have or create the incentive to personally observe a safe procedure.

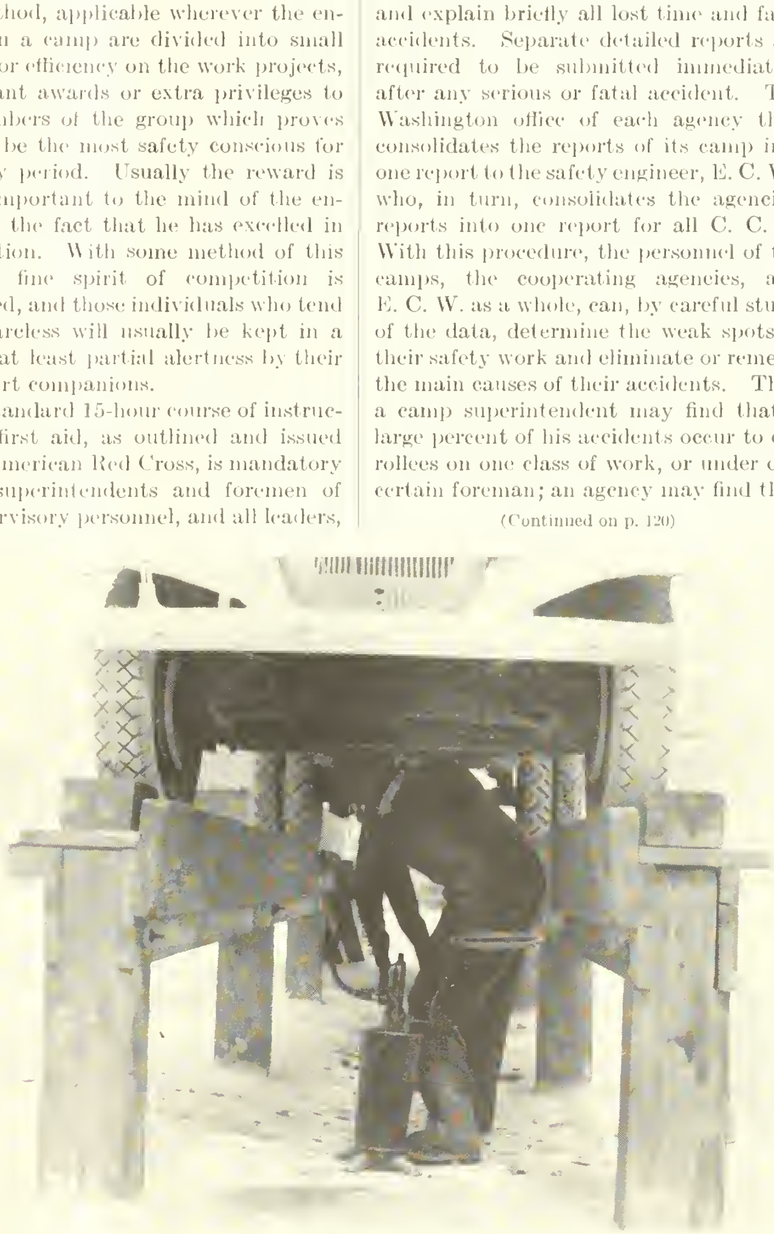
There is the ever present subconscious thought in many people that accidents may possibly happen to the other fellow but that they themselves are immune. Many ingenious methods have been used to overcome this thought and to create alertness and wide-awakeness in each individual enrollee. Any method which includes the idea of competition is usually very effective with the men of the C. C. C. One method, applicable wherever the enrollees in a camp are divided into small groups for efficiency on the work projects, is to grant awards or extra privileges to the members of the group which proves itself to be the most safety conscious for a weekly period. Usually the reward is not as important to the mind of the enrollee as the fact that he has excelled in competition. With some method of this kind, a fine spirit of competition is developed, and those individuals who tend to be careless will usually be kept in a state of at least partial alertness by their more alert companions.

The standard 15-hour course of instruction in first aid, as outlined and issued by the American Red Cross, is mandatory for all superintendents and foremen of the supervisory personnel, and all leaders, and assistant leaders of the enrollee personnel, but is elective for all other enrollees. Those who elect the course are given the same training and a certificate of attainment when they have mastered the course. The more proficient members of the elective group are assigned to the different work groups and are able, with the use of the ever present regulation first-aid kit, to give prompt and competent attention to all injuries and minor cuts and bruises.

ACCIDENT RECORDS

Each C. C. C. camp makes a monthly report to the Washington office of the Bureau or Agency under whose direction it operates. The reports of the Bureau of Reclamation camps list and classify as to cause, all minor accidents; and list, classify, and explain briefly all lost time and fatal accidents. Separate detailed reports are required to be submitted immediately after any serious or fatal accident. The Washington office of each agency then consolidates the reports of its camp into one report to the safety engineer, E. C. W., who, in turn, consolidates the agencies' reports into one report for all C. C. C. With this procedure, the personnel of the camps, the cooperating agencies, and E. C. W. as a whole, can, by careful study of the data, determine the weak spots in their safety work and eliminate or remedy the main causes of their accidents. Thus a camp superintendent may find that a large percent of his accidents occur to enrollees on one class of work, or under one certain foreman; an agency may find that

(Continued on p. 120)



ELEVATED GREASE RACK USED BY C. C. C. INSTEAD OF DANGEROUS GAS-COLLECTING GREASE PITS

Notes for Contractors

Specification no.	Bid opening	Project	Work or material	Low bidder: Name	Low bidder: Address	Bid	Terms	Contract awarded
	1937							
706	Mar. 4	Central Valley, Calif.	25 duplex cottages at Government camp, Friant Dam.	W. J. Ochs	Fresno, Calif.	$74,808.00		Apr. 8
720	Mar 3	Boulder Canyon, Ariz.-Nev.	230-kilovolt oil circuit breakers, disconnecting switches and lightning arresters.[1]	Westinghouse Elec. & Mfg. Co.	Denver Colo	[2] 100,290.00	F. o. b. Boulder City	Apr. 20
				Westinghouse Elec. & Mfg. Co.	do	[3] 9,090.00	do	Do.
721	Mar. 12	Boise-Payette, Idaho.	Earthwork, canal lining and structures, Black Canyon Canal, stations 782+80 to 1250.	J. A. Terteling & Sons	Boise, Idaho	184,007.00		Apr. 3
722	Mar. 16	Salt River, Ariz.	50- by 50-foot regulating gates for spillway.	American Bridge Co	Chicago, Ill.	483,278.00	F. o. b. Ambridge, Pa.	Do.
723	Mar 8	Parker Dam, Ariz.-Calif. Rio Grande, N. Mex. Upper Snake River, Idaho.	High-pressure gates for outlet works.	Koppers Co. (Western Gas Division).	Fort Wayne, Ind.	[4] 38,000.00	F. o. b. Fort Wayne	Mar. 20
				Commercial Iron Works.	Portland, Oreg	[5] 3,425.00	F. o. b. Portland, Oreg.	Mar. 17
725	Mar 25	Sun River, Mont	Alterations to spillway at Gibson Dam.	McLaughlin Construction Co.	Livingston, Mont.	53,275.00		Apr. 12
726	Mar. 19	Casper-Alcova, Wyo	Three 25 feet 8 inch by 40 feet fixed wheel gates for spillway at Alcova Dam.	Commercial Iron Works.	Portland, Oreg.	[4] 44,870.00	do	Do.
				American Bridge Co.	Denver, Colo.	[5] 13,521.00	F. o. b. Gary, Ind.	Do.
719	Mar. 1	Central Valley, Calif.	Earthwork and structures, Contra Costa Canal, stations 2+00 to 208+50.	Haas, Doughty & Jones and Marshall & Stacy.	San Francisco, Calif.	102,646.00		Mar. 19
875-D	Feb. 18	Boulder Canyon, Ariz.-Nev.	Motor-driven fans, surface cooler, air-flow control equipment for ventilating and air-cooling system.	U. S. Air Conditioning Corporation.	Minneapolis, Minn.	[4] 462.00	F. o. b. Boulder City, 3 percent discount.	Apr. 6
				The New York Blower Co.	Chicago, Ill.	[5] 290.00	do	Do.
				Clarage Fan Co.	Kalamazoo, Mich.	[6] 585.00	F. o. b. Kalamazoo, Mich.	Apr. 7
				Air Conditioning Engineers, Inc.	Phoenix, Ariz.	[7] 1,118.00	F. o. b. Boulder City	Apr. 5
881-D	Mar. 4	do	1 carbon-dioxide fire extinguishing system and 40 spare cylinders of carbon-dioxide for Boulder power plant.	C-O-Two Fire Equipment Co.	Newark, N. J.	[4] 5,569.00		Apr. 8
883-D	Mar. 3	Central Valley, Calif.	Construction of water tank at Government camp, Friant Dam.	Western Pipe & Steel Co.	San Francisco, Calif.	[4] 3,350.00	F. o. b. Friant, Calif.	Mar. 11
885-D	do	Colorado River, Tex.	Liquid-gas storage and gasifying plant, piping system, heaters, meters, and liquid gas.	Frank F. Spiller	Austin, Tex.	3,979.00	F. o. b. Austin, Tex.	Do.
886-D	Mar. 10	Columbia Basin, Wash.	Pipe, fittings, valves, and appurtenances for bypass drain and air-inlet piping for paradox and ring-follower gates.	Geo. B. Limbert & Co.	Chicago, Ill.	54,597.00	F. o. b. Kewanee, Ill., Chicago, Ill., Pittsburgh, Pa., and Hartford, Conn., 2 percent discount.	Mar. 27
888-D	Mar. 12	Colorado River, Tex.	Street, driveway, and sidewalk grading and surfacing and sewer and water systems, Government camp at Marshall Ford Dam.	Brown & Root, Inc.	Austin, Tex.	13,318.25		Do.
892-D	Mar. 26	Boulder Canyon, Ariz.-Nev.	2 welded plate-steel cylindrical bulkheads for relief valves of turbines at Boulder power plant.	Emsco Derrick & Equipment Co.	Los Angeles, Calif.	5,820.00	F. o. b. Los Angeles	Mar. 30
895-D	Mar. 30	Rio Grande, N. Mex.	2 50- by 21-foot automatic radial gates for spillway at Caballo Dam.	John W. Beam	Denver, Colo.	19,000.00	F. o. b. Chicago, Ill.	Apr. 12
896-D	Mar. 31	Moon Lake, Utah	Fabricated structural steel, gratings, stair treads, pipe and fittings, walkways, and miscellaneous metalwork for Moon Lake outlet works.	John W. Beam	do	[4] 625.00	F. o. b. Peotone, Ill., ½ percent discount.	Apr. 9
				Omaha Steel Works	Omaha, Nebr.	[5] 660.00	F. o. b. Kansas City, Mo., ½ percent discount.	Do.
				Hansell Elcock Co.	Chicago, Ill.	[6] 215.00	F. o. b. Chicago, Ill., ½ percent discount.	Do.
882-D	Mar. 6	Central Valley, Calif.	Concrete-testing laboratory and combination garage and fire station at Friant camp.	MacDonald Construction Co.	St. Louis, Mo.	19,095.50		Apr. 16
897-D	Mar. 31	Parker Dam, Ariz.-Calif.	Draft-tube stop-log guides and metalwork for stop logs for Parker power plant.	California Steel Products Co.	San Francisco, Calif.	8,447.00	F. o. b. San Francisco	Apr. 12
898-D	Mar. 30	do	200,000 bbls. of low-heat Portland cement in bulk.	Riverside Cement Co.	Los Angeles, Calif.	298,000.00 (comb. bid)	F. o. b. mills	Apr. 16
				California Portland Cement Co.	do			
				Southwestern Portland Cement Co.	do			
				Monolith Portland Cement Co.	do			
901-D	Apr. 2	Carlsbad, N. Mex.	Stairways, walkways, and miscellaneous metalwork for spillway and outlet works at Alamogordo Dam.	Duffin Iron Co.	Chicago, Ill.	[4] 1,150.00	F. o. b. Chicago	Apr. 12
				Omaha Steel Works	Omaha, Nebr.	[5] 700.00	F. o. b. Kansas City, ½ percent discount.	Apr. 13
				John W. Beam	Denver, Colo.	[6] 985.00	F. o. b. Chicago, ½ percent discount.	Do.
903-D	Apr. 6	All-American Canal, Ariz.-Calif.	Cast-iron slot tips for installation in influent channels of desilting works at Imperial Dam.	Madsen Iron Works Ltd.	Huntington Park, Calif.	9,722.00	F. o. b. Huntington Park.	Apr. 14
904-D	Apr. 5	Rio Grande, N. Mex	Plate-steel, Venturi meter tube and appurtenances for installation in outlet works at Caballo Dam.	Berkeley Steel Construction Co.	Berkeley, Calif.	3,850.00	F. o. b. Berkeley, ½ percent discount.	Do.
[illegible]-D	Mar. 29	Columbia Basin, Wash.	Bulkhead-gate frame and track assemblies for outlet works at Grand Coulee Dam.	Koppers Co. (Bartlett Hayward Division).	Baltimore, Md.	25,970.00	F. o. b. Baltimore, ½ percent discount.	Apr. 16

[1] All bids rejected on schedule 2. [2] Schedule 1. [3] Schedule 3. [4] Item 1. [5] Item 2. [6] Item 3. [7] Item 4.

Reclamation Organization Activities and Project Visitors

John C. Page, Commissioner of Reclamation, addressed the Thirty-second Annual Convention of the National Rivers and Harbors Congress at the Mayflower Hotel in Washington, D. C., on April 26, his subject being River Regulation in our National Conservation Program. The address will appear in the June issue of the ERA.

Commissioner Page is receiving the congratulations of his official associates and many other friends on the arrival of his first grandchild, a baby girl born on April 3 to Mr. and Mrs. C. L. Killgore in Boulder City, Nev. Mrs. Killgore is the daughter of the Commissioner, and Mr. Killgore is a reclamation engineer on the Boulder Canyon project. The new baby is Carolyn Chatfield.

J. L. Savage in London

J. L. Savage, Chief Designing Engineer for the Bureau of Reclamation, with offices in Denver, sailed from New York on April 7, for London, where at the invitation of the British Institution of Civil Engineers, he delivered an address on The Boulder Dam on April 15.

While in London Mr. Savage attended, as a representative of the Bureau of Reclamation, meetings of the subcommittee of the International Congress on High Dams of the Third World Power Conference and the International Association for Testing Materials, April 19 to 22. As a feature of his lecture before the British Institution of Civil Engineers Mr. Savage showed a four-reel sound film of the construction of Boulder Dam, just completed by the Bureau of Reclamation, as the official record of this work.

W. R. Nelson Addresses Engineers in Baltimore

Wesley R. Nelson, engineer in the Washington office of the Bureau of Reclamation, gave an address in Baltimore, Md. on April 19 at the dinner meeting held at the Faculty Club of Johns Hopkins University in connection with the Second Annual Conference of the Student Chapters of the American Society of Civil Engineers from the Universities of George Washington, Maryland, Johns Hopkins, and the Catholic University of America.

Mr. Nelson's address on "The Columbia Basin Project" was illustrated with lantern slides and was followed by a showing of motion pictures.

Carl Voyen, Jr., Dies

Carl Voyen, Jr., aged 18 years, popular Casper, Wyo., high-school student and outstanding athlete, died at the home of his parents, Mr. and Mrs. C. M. Voyen at Casper, on March 31. Death was the result of a head injury from which the young man had suffered for many months.

Carl was rated as an all-around high-school athlete in 1935, and was well known for his prowess in football and other sports. His father, Carl M. Voyen, is chief clerk of the Casper-Alcova project.

The Secretary of the Interior has authorized the following appointments in the Bureau of Reclamation:

Washington office:

Miss Ruth Adair, senior typist, vice Miss Grace M. Conant, resigned; and Rodney Knowles, clerk, Accounting Division.

Mrs. Alice L. Murphree, junior clerk-typist, Emergency Conservation Work Division.

Denver office:

Mrs. Love Corrine Day, junior clerk, widow of Charles M. Day, mechanical engineer.

Martin W. Tierney, under clerk.

Arthur E. Lindgren, assistant blueprint operator, vice Granville T. Marts, resigned.

Carl L. Myers, junior engineer, to fill the position left vacant by recent resignation of Jacob H. Douma.

Fresno Dam, Milk River project, Havre, Mont.:

Miss Harriett J. Howard, junior clerk.

Parker Dam:

Charles H. Kibler and Paul J. Gehringer, inspectors.

Rio Grande Project, El Paso, Tex.:

Miss Eleanor A. Betzel, junior clerk.

Boulder Canyon project, Boulder City, Nev.:

Martin J. Halseth and Allen Abbott, cashiers.

John O. Holland, Don H. Scott, Milo A. Slawson, William J. Dunne, Philip Brim, Paul Lytle, and John L. Pulsipher, Jr., guides.

Roza Division, Yakima project, Wash.:

Willard L. Collins and James E. Morris, inspectors.

Columbia Basin project, Wash.:

Frank A. Mueller, senior engineering draftsman, by reinstatement.

Resignations of recent date are as follows:

Miss Evelyn T. Child, assistant clerk-stenographer, Emergency Conservation Work Division, Washington office.

Robert W. Burton, junior engineer, Denver office, to accept an offer of employment with the Chain Belt Co., Milwaukee, Wis.

Russell C. Link, assistant engineer, Parker Dam, Calif.

Oliver Noah Fowler, junior engineer, Denver office.

Kenneth H. Ryan, engineering draftsman, Grand Coulee Dam, Columbia Basin project, Wash.

James G. McKnight, engineering draftsman, Denver office.

The following recent transfers have been authorized by the Secretary of the Interior:

To the Denver office:

Clemeunt T. Douglass, Jr., associate engineer, from Central Valley project (Kennett Dam) Redding, Calif.

Daniel Clark, associate engineer, and Alison Tewksbury, assistant engineer, from Boulder Canyon project, Boulder City, Nev.

James L. Darnell, Jr., assistant geologist, from the Colorado River project, Austin, Tex., to the Eastern Slope Investigations, Denver.

Ralph G. Tuttle, junior engineer, from the Columbia Basin project, Coulee Dam, Wash.

From the Denver office:

Marion S. Ross, assistant engineer; and Cecil G. Bargeron, junior engineer, to the Salt Lake Basin project (Sanpete project), Salt Lake City, Utah.

Louis H. Ruhlen, inspector, to the All-American Canal project, Imperial Dam, Yuma, Ariz.

Claude H. Studebaker, junior engineer, to the Boise project, Boise, Idaho.

Henry J. Tebow, assistant engineer, to the Boise investigations, Boise, Idaho.

Charles H. Carter, associate engineer, to engineer, Salt Lake Basin project, Salt Lake City, Utah.

William Killmore, assistant engineer, to the Heart Mountain Division, Shoshone project, Cody, Wyo.

Charles N. Cairns, junior engineer, to the Owyhee project, Boise, Idaho.

Stanley Kebbe, junior engineer, to the Burnt River project, Unity, Oreg.

Robert W. Jennings and Uno V. Engstrom, junior engineers, to the Salt Lake Basin (Provo River) project, Provo, Utah.

Elmo C. Higginson, junior engineer, to the Owyhee project, Boise, Idaho.

Carl F. Olsen, inspector, to the Moon Lake project, Duchesne, Utah.

Russell C. Borden and Harry H. McLean, inspectors, to the Burnt River project near Unity, Oreg.

L. R. Brooks, assistant engineer, to Riverton project, Wyoming.

Among the recent visitors to the Boulder Canyon project were the following: Mrs. John C. Page, wife of Commissioner Page; J. L. Savage, chief designing engineer, and F. F. Smith, engineer, Denver office; Horace L. Mann, president, Buffalo General Electric Co., Buffalo, N. Y.; Fong Lan Lee, Chinese Government student; and Mr. Felt, Acting Director P. W. A., State of Nevada.

Fred O. Belter, a foreman in the E. C. W. organization of Camp BR–57, Ballantine, Mont., passed away on April 6, in Billings, Mont., as the result of a heart attack. Mr. Belter had been with the E. C. W. organization since the camp was established in September 1935. For a number of years he was employed by the Bureau of Reclamation as a foreman on the Huntley project, and was also employed by the Huntley project irrigation district as general foreman from March 1, 1928, to September 15, 1935. Mr. Belter was born in Wisconsin, October 3, 1884.

S. A. Nelson, president of the First National Bank of Powell, Wyo. (Shoshone project), and owner of a large acreage of irrigated project land, died at San Diego, Calif., on March 30. Mr. Nelson had been in poor health for several years and retired from active management of the bank several months ago. He represented the water users on the Garland division in their dealings with this Bureau for a number of years and exerted a great deal of influence in this community until recent years.

L. R. Fiock, Superintendent of the Rio Grande project was in the Washington office the latter part of April on business connected with the project.

Miss Katherine T. Ashlin, stenographer in the Washington office, was transferred to the Boulder Canyon project, effective April 22, as secretary to City Manager Sims Ely.

Theodore R. Sheppard, for many years employed as messenger in the administrative office of the Bureau of Reclamation, has been promoted to a clerkship in the Public Relations division of the Washington office.

"See America First"

Acting upon a suggestion made to Secretary of the Interior Harold L. Ickes by Hon. Ernest N. Hutchinson, secretary of state of the State of Washington, the National Park Service and the Reclamation Service, both being bureaus of the Department of the Interior, are cooperating with leading western railroads in an unusual type of "See America First" tours.

As pointed out by the secretary of the State of Washington, the national recovery program has made possible the rebuilding of the West through such public works as the Grand Coulee Dam in Washington, the Bonneville Dam, which harnesses the Columbia River, and Boulder Dam, in the Southwest. California has joined in the cavalcade of gigantic engineering works with its world-renowned Bay Bridge across San Francisco Bay, and its equally famous Golden Gate Bridge.

These projects are not only stupendous in respect to their engineering achievements, but are so revolutionizing the industrial opportunities in areas formerly stagnant for lack of water and water power that only by actual ocular evidence can their magnitude be realized. Millions of Americans who would welcome the opportunity to see these vast changes in process of construction have been unable to do so because of the high costs of transcontinental travel.

Special low-priced schedules of about 3 weeks' duration for the round trip for easterners therefore have been worked out, through the cooperation of the railroads, with special consideration for the time limits by which the average American's vacation is bounded.

Stop-overs will be made in Yellowstone National Park, Wyo., and Mount Rainier National Park, Wash., where special motorbus tours will enable the tourists to cover the points of greatest interest. An auto tour to the summit of Pike's Peak also is included.

The projects visited will include the Grand Coulee Dam in the State of Washington, still under construction; the huge Bonneville Dam, which harnesses the Columbia River for the joint benefit of the States of Washington and Oregon; and the mammoth Boulder Dam on the borders of Nevada and Arizona, the world's largest finished project of the kind, built in record-breaking time.

Opportunities to see at close range such key cities as Chicago, San Francisco, Los Angeles, Salt Lake City, and Denver will be afforded by side trips in automobiles.

Educationally as well as scenically the route covered by these "See America First" itineraries offer to the American public a rare opportunity to appraise for themselves the wonders of modern engineering and the grandeur of the Nations' natural wonders.

The Value of Diversified Farming in Powell Valley

The First National Bank of Powell, Wyo. has recently initiated a unique plan for presenting to farmers, facts and figures on the value of diversified farming by using their advertising space in the Powell Tribune to print the crop reports compiled by the irrigation district.

"Let's maintain and increase the prosperity of the Powell Valley by planning a diversified crop program," states this interesting bank advertisement. "The following figures, compiled by the Shoshone Irrigation District as an average for all farms on the Garland Division, show the Gross per-acre income on our major crops for the past 12 years. We believe a study of these figures over a representative period of years will prove the value of Diversified farming, as opposed to a one-crop farm program."

The importance of selecting crops to meet market requirements, for feeding, and for maintenance of soil fertility and to keep the crop program so diversified from year to year that irrigation farmers will net a profit, is of vital importance. All projects could well give thought to interesting farmers in studying crop reports.

Safety in CCC Camps

(Continued from p. 117)

10 or 20 percent of its camps have a large percentage of its accidents; and the safety engineer may find that some of the agencies have an ineffective safety program. With this constant check and the spirit of competition existing between agencies, between camps, and between individuals, the accident rate for Civilian Conservation Corps has shown a satisfactory and constant decrease or downward trend amounting to 25 percent in the past 2 years.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page,** Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr. of Operation and Maintenance; A. R. Golzé, Supervising Engineer, E. C. W. Division; William F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief, Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz	R. B. Williams	Constr. engr	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr	Robert B Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev	Ralph Lowry	do	Gail H. Baird	R. J Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Fort Sumner, N Mex	Wilfred W. Baker	Constr. engr		do	Do.
Casper Alcova	Casper, Wyo	H. W. Bashore	do	C. M. Voyen	W. J Burke	Billings, Mont
Central Valley	Sacramento, Calif	W. R. Young	do	E R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Frenchtown, Mont				W. J. Burke	Billings, Mont.
Gila	Yuma Ariz	R. B. Williams	Constr. engr		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Superintendent	Emil T Ficener	J R Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev.	L. J. Foster	Constr. engr	George B. Snow	do	Do.
Klamath	Klamath Falls, Oreg	B E. Hayden	Superintendent	W. I. Tingley	B E Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont	H. H. Johnson	do	E. E. Chabot	W J Burke	Billings, Mont.
Fresno Dam	Havre, Mont	H. V. Hubbell	Constr. engr	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Acting supt	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr	Francis J. Farrell	J R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr engr	H W. Johnson	J R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif	D. L. Carmody	Superintendent	W. D. Funk	R. J Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B E Stoutemyer	Portland, Oreg.
Parker Dam [3]	Parker Dam, Calif	E. A Moritz	do	George W. Lyle	R. J Coffey	Los Angeles, Calif.
Pine River (Vallecito Dam)	Bayfield, Colo	Charles A. Burns	do		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	Superintendent	H. H Berryhill	H. J S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N Mex	S. F. Crecelius	Constr. engr		do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	C B Wentzel	W. J. Burke	Billings, Mont
Salt River	Phoenix, Ariz	E. C. Koppen	Constr. engr	Edgar A Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo	Walter F. Kemp	Constr. engr	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont	A. W. Walker	Superintendent		do	Do.
Truckee River Storage	Reno, Nev.	L. J. Foster	Constr. engr	George B Snow	J R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg	C. L. Tice	Reservoir supt		B. E. Stoutemyer	Portland, Oreg
Uncompahgre: Taylor Park	Gunnison, Colo	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo	C. B. Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage [4]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash	J. S Moore	do	Philo M. Wheeler	do	Do.
Roza division	do	Charles E Crownover	Constr engr	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz	R C. E. Weber	Superintendent	Noble O Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting. [3] Non-Federal. [4] Island Park and Grassy Lake Dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg	A. J. Ritter	President	F. A. Phillips	Keating
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H Tuller	Project manager	F. J. Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M Watson	Caldwell.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo	Charles Tharp	do	C. J. McCormich	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine Mont	E. E Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A	Wellsville Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr	President	Dorothy Eyers	Do
Lower Yellowstone	Board of Control	Sidney, Mont	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook division [1]	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo	Bert L. Adams	do	Mary Harrach	Torrington.
Northport division	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	Superintendent	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	H. J. Lawson	do	F. C. Henshaw	Phoenix.
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo	F. E. Martin	President	Geo. W. Atkins	Powell.
Fannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn	Payson, Utah	William Grotegut	President	E. G. Breeze	Payson.
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D. Martin	Hermiston.
West division	West Extension irrigation district	Irrigon, Oreg	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose.
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash	W. V. Russell	Manager	G. L. Sterling	Ellensburg.

[1] Operated by 5 irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash	F. A. Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo	Mills E. Bunger	Senior engineer.
Gallatin Valley	Bozeman, Mont	R. R. Robertson	Engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Do.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo	Frank C. Merriell	Do.
Black Hills	Rapid City, S. Dak	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	Denver, Colo	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do.
Conchas	Tucumcari, N. Mex	J. A. Keimig	Associate Engineer.
Grande Ronde	La Grande, Oreg	C. C. Fisher	Engineer.

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget. SALLIE A. B. COE, *Editor.*

COLUMBIA BASIN PROJECT, WASHINGTON.

REMOVING THE SILT LAID IN THE COLUMBIA RIVER CHANNEL IN GLACIAL AGES. THIS EXCAVATOR IS AT WORK IN THE CENTRAL SECTION WHERE UNTIL A FEW MONTHS AGO THE COLUMBIA RIVER FLOWED AT GRAND COULEE DAM, NOW BEING CONSTRUCTED BY THE BUREAU OF RECLAMATION AS THE PRINCIPAL ENGINEERING FEATURE OF ITS COLUMBIA BASIN PROJECT, IN EASTERN WASHINGTON. THE STEEL COFFERDAM CELLS BY WHICH THE RIVER WAS DIVERTED FROM ITS COURSE TOWER ABOVE THE EXCAVATION.

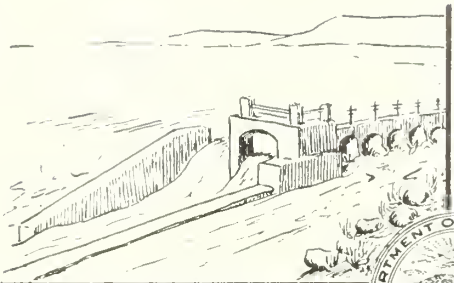
THE RECLAMATION ERA

VOL. 27, NO. 6 JUNE 1937

DESERT LAND WAITING FOR WATER.

A HIGHLY DEVELOPED VALLEY—ONE OF THE RESULTS OF FEDERAL RECLAMATION.

THIS EXAMPLE OF THE TRANSFORMATION OF DESERT TO PRODUCTIVE LAND HAS BEEN REPEATED OVER AND OVER AGAIN SINCE THE PASSAGE OF THE RECLAMATION ACT, 35 YEARS AGO.

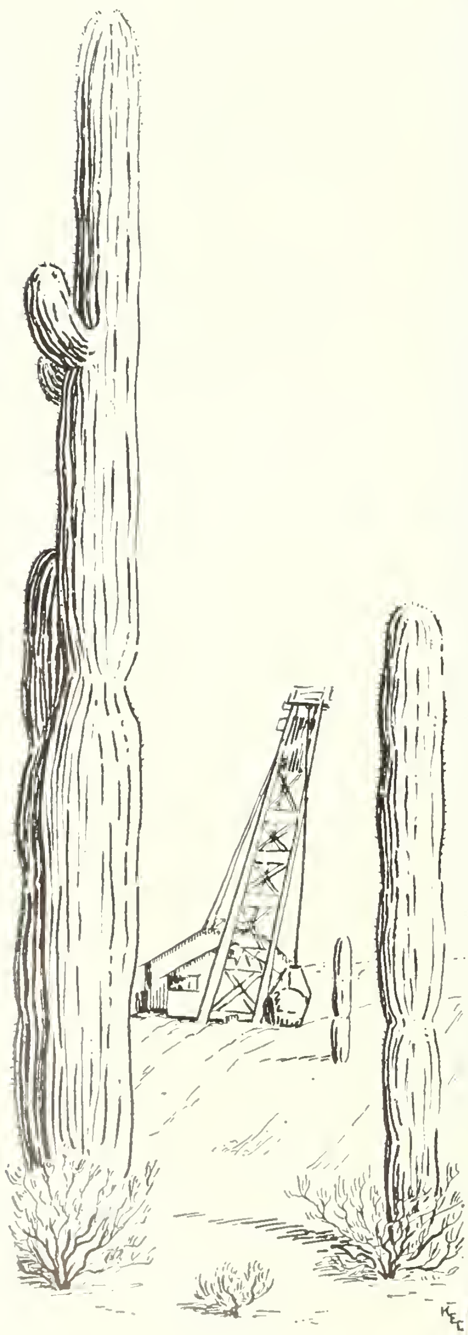


THE RECLAMATION ERA

PRICE 75 CENTS A YEAR

HAROLD L. ICKES
SECRETARY OF THE INTERIOR

JOHN C. PAGE
COMMISSIONER, BUREAU OF RECLAMATION



CONTENTS

River Regulation in Our National Conservation Program

By John C. Page, Commissioner of Reclamation [1]

FROM Maine to California, the life of every citizen of the United States is affected in some manner by one or more of the problems connected with water.

A fortunate few are faced with only one problem, and perhaps it is of minor importance. But many millions are confronted with several, some of them presenting serious threats to health, to property, to the ability to earn a livelihood, or to life itself.

The uses of water are many and important, but every use creates a corresponding problem, and the problems are growing more complex day by day. Despite the prevalence of these problems, little progress has been made toward solving them except on a local and often a temporary basis. A broader approach is needed and more permanent solutions must be found.

The National Resources Committee now is encouraging a broader understanding. Its monumental study and report on Drainage Basin Problems and Programs has provided the first national inventory of water problems and the outline of a national plan for their correction. If this work is used as the foundation for a national program to be revised and added to year by year, there is every reason to believe that many of the mistakes of the past can be eliminated and the problems which arise from them can be solved.

A remarkable feature of the Resources Committee's report is the disclosure that generally in all sections of the country the most efficient method of meeting present difficulties will be found in the regulation of our rivers through the control and conservation of their waters.

Many purposes are served by regulation to smooth out the peaks and valleys of the flow chart of a stream. Floods thus are curtailed, navigation improved, a more reliable water supply is provided for domestic use, and, in the West where irrigation is necessary, pollution is somewhat abated and more favorable conditions are provided for fish life. All of these benefits, it will be seen, are among the objectives of the national conservation program. In addition, the dams and reservoirs which must be constructed to achieve a regulated flow, in a great many instances will make possible the incidental generation of hydroelectric power, to help defray the costs of the projects and at the same time improve the public lot.

MAJOR WATER PROBLEMS

Three major water problems have been attacked in the past on a broad national basis. They are flood control, navigation, and irrigation.

Flood control and navigation improvements, as is well known, have been placed under the jurisdiction of the Corps of Engineers, War Department, one of the world's outstanding engineering agencies. The responsibility of constructing and operating irrigation improvements rests with the Bureau of Reclamation, Department of the Interior.

All of you, at this meeting, are familiar with the history and objectives of the work of the Corps of Engineers, so that it is unnecessary for me to comment upon them. However, as a representative of the engineering profession, I would like to pay tribute to its unexcelled record of useful and valuable work.

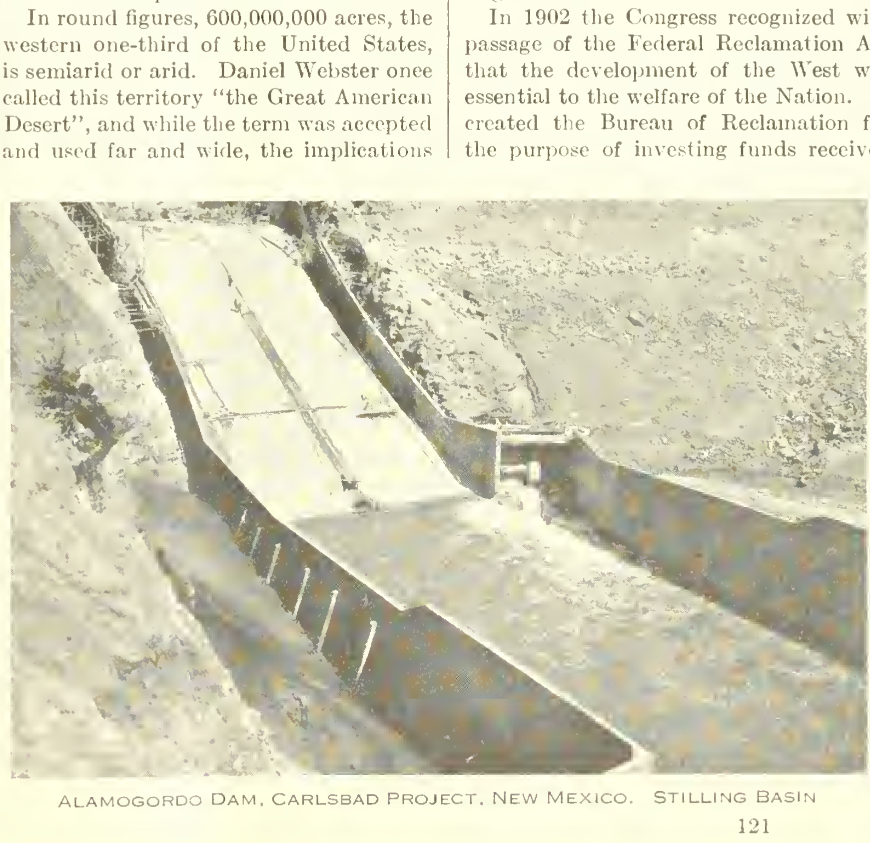
Since the activities of the Bureau of Reclamation are closely confined to one region, the semiarid and arid West, a general understanding of its work and objectives is not so widespread. For that reason, I should like your indulgence for a moment to speak of these.

In round figures, 600,000,000 acres, the western one-third of the United States, is semiarid or arid. Daniel Webster once called this territory "the Great American Desert", and while the term was accepted and used far and wide, the implications of it never were generally understood. Here is an empire with deficient rainfall, where the water problem is the reverse of that you have to face. It is not periodic floods, but continuous drought that confronts the people who inhabit this region. Because of this condition, the West is far advanced in its thinking concerning water in comparison with other sections of our country. Since all agriculture and life itself in the West are dependent upon conservation and careful use of what little water is made available by nature, from earliest days water has been recognized as the primary resource, and the control of it as the most vital function.

INSUFFICIENT WATER TO IRRIGATE ARID WEST

It has been shown by careful analysis that when all the waters in all the rivers draining these vast Western States is conserved and used, only about 4 percent of the land area of this region can be irrigated and thus made productive. Already this area has about 11 percent of the Nation's population. Its population is increasing year by year, but it never can have an agriculture as extensive as, for example, the State of Kansas. There simply is insufficient water to serve a larger area.

In 1902 the Congress recognized with passage of the Federal Reclamation Act that the development of the West was essential to the welfare of the Nation. It created the Bureau of Reclamation for the purpose of investing funds received



ALAMOGORDO DAM, CARLSBAD PROJECT, NEW MEXICO. STILLING BASIN

[1] Address delivered Apr. 26 before Thirty-second Annual Convention of the National Rivers and Harbors Congress, at the Mayflower Hotel, Washington, D. C.

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from the sale of western public lands in self-liquidating irrigation projects.

Since that time the Bureau of Reclamation has been engaged in the work of strengthening the agricultural foundation upon which the civilization of one-third of this country is built. It has constructed about two score projects for irrigation of an area only two-thirds as big as Connecticut. All the cost of these projects has been levied against the lands improved. The investment is being repaid and will be repaid in full.

It might seem, at first glance, that this work is so small and the acreage served so insignificant in comparison with national totals as to be of relatively little importance. The value of Robinson Crusoe's goat, however, was not measured by its size, but by the overwhelming need of Robinson Crusoe for a goat. So it is with Federal Reclamation. The value of these projects in the West is not measured by their size, but by the West's overwhelming need for land in any amount which can be made productive.

It might be said that the West has long been "water conscious." It can be said that the whole Nation rapidly is becoming so. No longer does the Nation extend only its sympathy to that section which suffers a catastrophe. The droughts of the Great Plains and the floods of the Ohio Valley have brought home to all of us that our Nation is not disjointed. We realize now that an injury to a member of the body politic can cause it to suffer in much the same way that a broken leg affects a man.

The realization has come that we must conserve and protect our resources and that water is one of the most important of these resources. Controlled and used, water adds to all other values, but uncontrolled and abused, it becomes an agent of destruction.

I submit that no conservation program which deals with forests, grazing lands, the soil, minerals, and wildlife, and leaves out water, is complete. Conversely, I believe it is evident that a program which would deal simply with water would be inadequate.

Soil erosion vitally affects regulation of our rivers, since the eroded earth can fill reservoirs and render them useless and since it can clog channels. Reforestation and afforestation and preservation of the public ranges have an important bearing on erosion and a direct and obvious influence on the problem of regulating our streams.

It is apparent that all conservation activities must be carefully coordinated, and that regulation of our rivers must be fitted meticulously into the conservation pattern.

Power Production at Boulder Dam

Boulder Dam, on June 1, will settle into its regular and permanent routine of power production, and from that date forward all Boulder Dam power purchase contracts will be in full force and effect.

Secretary of Interior Harold L. Ickes on May 11 notified the first group of purchasers of Boulder Dam power that on June 1 the Bureau of Reclamation would be ready to deliver hydroelectric energy on a firm or continuous basis.

The service of this notice automatically sets in motion the whole train of contracts for purchase of Boulder Dam power, and, in addition, will increase by more than 300 percent the revenue to the Government from the power now being generated at Boulder Dam.

The notices were issued to the Department of Water and Power of the City of Los Angeles, to the City Council of Burbank, Calif., to the mayor of Glendale, Calif., to the board of directors of Pasadena, Calif., representatives of the four municipalities which are power contractors. It informed the power contractors that in accordance with article 11 (*a*) of the contract for lease of power privilege at Boulder Dam dated April 26, 1930, notice is served that 1,250,000,000 kilowatt-hours of energy per year will be ready for delivery on June 1, 1937.

The Boulder Dam power purchase contracts stipulated that notice of availability of 1,250,000,000 kilowatt-hours of electric energy per year would serve to place the contracts on a firm power basis, thus requiring payment of 1.63 mills per kilowatt-hour for energy received.

Under an interim contract which has been in effect since the first generator went into service at Boulder Dam last autumn, these municipalities have been obtaining their power for payment of half a mill per kilowatt-hour, the rate assigned for secondary energy.

It is expected that the revenues to the Government from the sale of Boulder Dam power in 1937 will approximate $1,500,000.

Slightly more than 11,000,000 acre-feet of water now is stored in Lake Mead behind Boulder Dam, and the prospects are that by the end of the spring flood run-off from the Colorado River watershed about 17,000,000 acre-feet will be in storage. With 17,000,000 acre-feet of water stored, a head of 472 feet will be supplied for the turbines in the powerhouse. The turbines in the power plant are designed to operate under a minimum head of 420 feet. The lake is expected to reach a depth sufficient to provide this minimum head before the end of May.

With the head available and 17,000,000 acre-feet in storage, it will be possible, beyond any doubt, to supply 1,250,000,000 kilowatt-hours of electric energy per year with the four generators now in operation.

The contracts for the purchase of Boulder Dam power negotiated with the utilities and other agencies, in addition to the four municipalities, contain provisions which make them automatically operative at definite intervals after the date when firm power is delivered on the Los Angeles contract.

A. S. A. E. meets

The thirty-first annual meeting of the American Society of Agricultural Engineers is to be held June 21–24 at the University of Illinois, Urbana. Technical division programs have been built up by the several chairmen and representative groups of members. The farm structures division will feature farm housing; agricultural engineer's responsibility in the promotion of better farm buildings, and papers on individual structural problems and developments.

Power and machinery division attention is to be centered on "The Farm Tractor Fuel Problem," "Quick Attachable and Detachable Power Farming Equipment," and "Natural and Artificial Curing of Forage Crops." The rural electric division will offer sessions on extending electric service in rural areas, assisting the farm customer, and electric service for the farm family.

In the soil and water conservation division a wide variety of irrigation, drainage, erosion control, and land use problems are slated for consideration.

Klamath Farm Clubs Active

A crowd estimated at 4,500 persons attended and viewed the 4–H and Future Farmers of America exhibits and contests at the Junior Spring Fair held at Klamath County Fair Grounds and Altamont School (Klamath project), on April 24. Initiated at this year's fair was the awarding of scholarships to summer school or summer camp in place of cash prizes to the various exhibition divisions. First and second place winners received full scholarships to Corvallis this summer, and third and fourth place winners have a choice of half scholarships to Corvallis or full scholarships to the 4–H summer camp.

The Reclamation Era

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

JUNE 1937

Thirty-five Years of Reclamation

The Bureau of Reclamation marks its thirty-fifth birthday on June 17, 1937. On June 17, 1902, President Theodore Roosevelt approved the Reclamation Act thus setting in motion the development of the arid and semiarid West by the Federal Government, which is of such vital interest not only to those who have established their homes on the lands deriving direct benefits, but indirectly to a marked degree the entire population of the United States. For instance, the engineering works already constructed have drawn on machinery and equipment from the markets of all sections of the country and the dams and appurtenant works now in process of construction continue to spread labor and purchases of such material over many States. The Grand Coulee Dam on the Columbia Basin project in Washington, our present work of greatest magnitude, is supplying employment to the labor producing machinery and equipment required in the construction; these materials to December 31 last were purchased from 40 States and the District of Columbia totaling $23,264,334; and in addition about $2,000,000 had been paid for freighting the purchases to the dam. Almost one-half of the money which had gone for materials and supplies was spent in States east of the Mississippi River; and nearly two-thirds was spent in the production of off-the-site labor.

ECONOMIC FEATURES

The irrigated area on Federal projects of the western third of the United States, exclusive of Warren Act projects, in 1906, the first year for which this record is available, was 22,300 acres; the cropped area was 20,100 acres; and the crop value was $244,900. At the close of 1936, the latest published report shows a total irrigated area including Warren Act projects of 3,038,187 acres; a cropped area of 2,902,278 acres and a cumulative total crop value over the years of $2,314,467,489.

While considering the benefits enjoyed by our country at large during the construction periods it is well also to contemplate the lasting benefits to the country resulting from this construction through the production of crops. The Haw-Schmitt report on Federal reclamation made to the Secretary of the Interior in 1935 gives the following facts:

"Data collected on a number of reclamation projects during October 1934 in a special study give a tangible basis for estimating the effect of reclamation production on general business. Records were obtained of the expenditures for purchases outside of the local trade territory by representative farmers, covering a period of 7 to 10 years. They show that 75 to 80 percent of the farm income was thus spent on the purchase of commodities produced in the industrial sections of the United States; in other words, only about one-fourth of the farm production income was used for irrigation operation, tax payments, labor, and local supplies, while three-fourths went into the general industrial and trade stream.

"Applying this result to the mean production of all the projects, taken at about $60,000,000 per year on the average we may conclude that the projects send about $45,000,000 each year into the industrial market."

Reclamation by irrigation has such an important place in the economics of the country that to fully appreciate its value we need only to think of a country with one-third of its area barren and useless, and of the thickly populated sections continually increasing but with resources being steadily drawn upon and rapidly diminishing with the increasing population. We need to visualize the Utah deserts as the Mormon pioneers first saw them, and contrast that dreary prospect with the orchards and gardens which now surround the State's beautiful capital city.

The irrigated country has allowed a spread of population, and the soil in that section under irrigation is producing many crops for local needs and for the shipment of specialized crops to other sections of this country and also to foreign markets.

SETTLEMENT AND ECONOMIC DATA

At the close of the fiscal year 1936 there were 46,462 irrigated farms with a population of 205,055 on the Federal Reclamation projects; 244 towns with a population of 635,208; 834 schools; 971 churches; 107 banks with a capital stock of more than $13,000,000; deposits of $210,767,000 and 241,150 depositors. Taxable property is thus created, congested areas are relieved, employment is spread, and the country as a whole is benefited.

With the work in progress these benefits will continue to increase. As in the past, the landless man and the manless land will be brought together, and the water salvaged by the engineering structures already completed and those now under construction, as well as the works which are in present prospect, will continue to bring life and happiness to the country west of the one-hundredth meridian and to spread its benefits to other sections throughout our great country.—*S. C.*

F. O. Hagie, of Yakima, Wash., was recently elected secretary of the National Reclamation Association with offices in Washington, D. C., and has tendered his resignation as executive secretary of the Yakima Chamber of Commerce.

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COMMISSIONER, (Date) ....

Bureau of Reclamation,

Washington, D. C.

SIR: I am enclosing my check [1] (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) ....

(Address) ....

....

[1] Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Thirty-Five Years of Dam Construction

By W. I. Swanton, Associate Engineer, Bureau of Reclamation, Washington, D. C.

WITH the dedication of the Boulder Dam by President Franklin D. Roosevelt on September 30, 1935, and the inauguration of the power development there by the President on September 11, 1936, about 25 years after his distinguished cousin, Theodore Roosevelt, had dedicated the Roosevelt Dam, there was brought towards fulfillment the extensive program of dam construction by the Bureau of Reclamation. The program has thus far involved the construction of 160 storage and diversion dams of all heights and volumes, ranging up to 727 feet for the Boulder Dam with a volume of 3,250,000 cubic yards, with 19 dams under construction at the present time.

With the passage of the Reclamation Act in 1902 plans were immediately made for commencing construction of a number of irrigation projects, and so rapidly was the program inaugurated that in the following year, 1903, construction of the Truckee diversion dam was commenced, and in 1904 a second diversion dam, the Carson Dam also in Nevada, was begun and excavation for the Minidoka storage dam, a large rock-fill structure with a concrete corewall, was commenced.

In 1905 construction of five large storage and diversion dams was begun, including the Roosevelt Dam on the Salt River in Arizona, the Laguna Dam on the Colorado River, 10 miles above Yuma, Ariz., and the Pathfinder and Shoshone Dams in Wyoming. The Roosevelt dam site was located 75 miles from Phoenix, the nearest railroad center, and it was necessary to do much preliminary work in the way of road and camp construction, and to manufacture cement which resulted in a saving of many thousands of dollars. The Roosevelt Dam is an arch-gravity structure of rubble masonry 284 feet in height. The Pathfinder Dam, named for Fremont, the pathfinder of the route through the North Platte River Valley, is a masonry gravity arch with a height of 218 feet. The Shoshone Dam is a rubble concrete arch 328 feet in height located in a canyon on the route to Yellowstone Park and for many years it was the "highest dam in the world." In contrast to these high storage dams, the Laguna Dam is of the low Indian weir type of concrete and rock fill, only 40 feet in height, nearly a mile in length and having a volume of nearly a half million cubic yards.

In the early days of reclamation 1906 was the banner year in the number of dams commenced, as construction of 12 dams was begun, including such widely scattered structures as Granite Reef in Arizona; Avalon and Leasburg in New Mexico; Boise and Deer Flat in Idaho; Lower Yellowstone, a rock-filled timber weir in Montana; Cold Springs in Oregon; Sunnyside diversion in Washington; and Belle Fourche storage near the Black Hills in South Dakota, an earth-fill structure with a volume of 1,600,000 cubic yards, having a concrete face to prevent erosion by wave action in this wide sweep of prairie country.

The Conconully Dam on the Okanogan project in Washington was begun in 1907. It is the first entirely hydraulic-fill type of structure built by the Bureau, having a height of 67 feet, a length of 1,000 feet, and a volume of more than 350,000 cubic yards. Other dams begun in this year include the Willow Creek storage dam on the Sun River project in Montana, and the Whalen diversion dam on the North Platte River in Wyoming.

The East Park storage dam on the Orland project in northern California was begun in 1908 and completed in 1910. It is a concrete gravity arch. Dodson diversion, a rock-fill crib dam on the Milk River project and the Bumping Lake storage dam on the Yakima project were started the same year and all of them were completed in 1910.

Elephant Butte and Arrowrock Dams.—One of the largest dams and the one which formed the largest reservoir until the completion of Boulder Dam, is the Elephant Butte Dam on the Rio Grande in New Mexico. It is a cyclopean-rubble gravity structure exceeding 300 feet in height, is nearly 1,200 feet long, and contains more than 600,000 cubic yards. It was necessary to build a railroad to the site, with extensive camps, and water and sewer systems. The dam was begun in 1910 and completed in 1916, and its construction was almost coincident with the building of the Arrowrock Dam on the Boise River in Idaho, an arch-gravity structure 50 feet higher but having practically the same volume. There was a friendly rivalry between the concreting forces on each of these dams, which resulted in their completion in record time with the most modern types of cableways and concrete mixers then in use. As with the Elephant Butte Dam it was necessary to do a large amount of preliminary work at the Arrowrock dam site in the shape of a railroad line and camps to facilitate construction located far from the nearest settlements.

Lahontan Dam.—The Lahontan Dam, located on the Newlands project in Nevada and named for a prehistoric lake, which was also begun in 1911 and completed in 1915, is an earth and gravel fill structure with two unique curved spillways leading to a circular spillway pool at the river bed.

Strawberry Dam.—The Strawberry Dam in Utah is an earth-fill structure with concrete corewall and stores water in the Colorado River Basin for irrigation of lands in the Great Interior Basin by means of a 3¾-mile tunnel through the Continental Divide. It was begun in 1911 and completed in 1913.

Grand Valley Dam.—One of the unique diversion dams built just previous to our entrance into the World War was the roller-crest dam on the Grand Valley project in Colorado, the plans for which had to be redrawn in this country on account of the difficulty of transportation from Germany. The concrete weir is surmounted by a steel roller crest in sections, with a total length of 542 feet, and permits the passing of flood waters without damage to nearby railway lines.

Tieton Dam.—The Tieton Dam, the largest earth-fill storage dam on the Yakima project, was commenced after the World War in 1921 and completed in 1925. It is a hydraulic sand and gravel structure with a concrete and clay corewall, having a height of 222 feet and volume of 2,000,000 cubic yards.

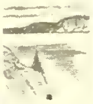
Stony Gorge Dam.—Engineering geology goes hand in hand with engineering design in the construction of the immense storage dams as a wise safety precaution. In the construction of the Stony Gorge Dam on the Orland project it was found necessary to bridge a fault zone and a reinforced concrete Ambursen type of structure was built, having a height of 142 feet, a length of 868 feet and containing 43,000 cubic yards of concrete.

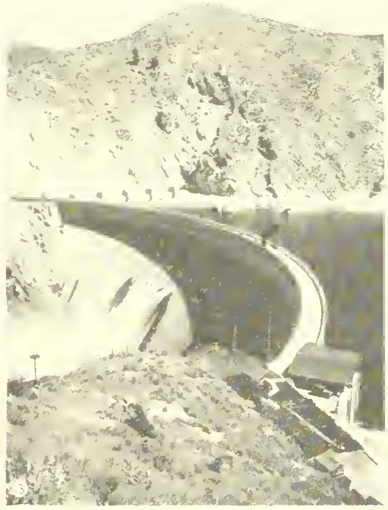
Owyhee Dam.—In the construction of the Owyhee storage dam in Oregon, the highest until eclipsed by Boulder Dam, it was necessary to locate the structure over a fault and an arched-gravity concrete dam was built with a height of 417 feet, length of 833 feet, and volume of 537,000 cubic yards. The cut-off wall in the fault cleft in the foundation was filled with concrete to a depth of more than 500 feet. One of the unique features of the outlet is a "glory hole" spillway—a circular outlet rising to the water surface of the reservoir when full and providing for an outflow to regulate the elevation.

Boulder Canyon Dam.—With the enactment into law of the Boulder Canyon

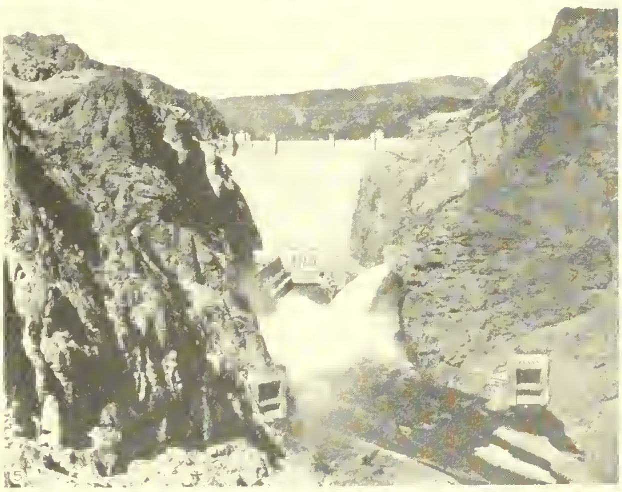
Project Act December 21, 1928, with its authorized appropriation of $165,000,000, preparations were made for the preliminary work looking to the construction of the immense dam in the canyon of the Colorado. When the first appropriation was made available the following year, active construction of the town of Boulder City in Nevada was begun, and construction of the railroad and highway to Las Vegas were started. The contract for the construction of the dam and appurtenant works at a cost of about $50,000,000 was awarded to the Six Companies in 1931, and the excavation of the four 56-foot diameter diversion tunnels for the outlet works in the canyon walls was pushed forward so rapidly that it was possible to lay the foundation of this dam 60 feet below the water level on June 6, 1933. The last batch of the 3,300,000 cubic yards of concrete was placed on May 29, 1935, 2 years ahead of schedule.

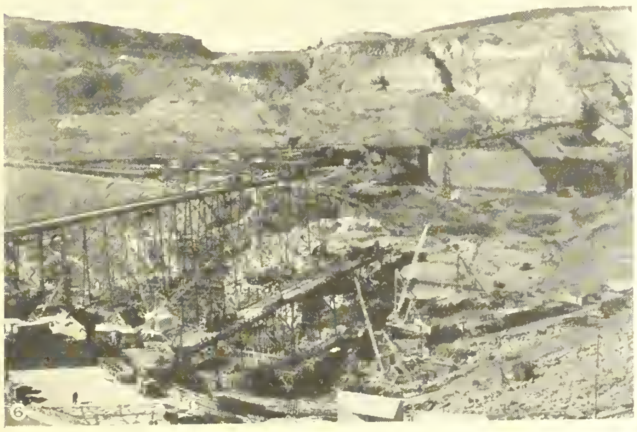
Grand Coulee Dam.—The largest and most noted dam under construction at the present time is the Grand Coulee Dam on the Columbia River in the State of Washington. This dam will have a height on completion of 550 feet, a length of 4,200 feet, a volume of concrete of 10,500,000 cubic yards, and will form a reservoir extending 150 miles in length to the Canadian border. Already the foundation portion of the structure is about three-fourths completed. The river having a flow 10 times that of the Colorado, or 250,000 second feet, has been diverted through a portion of the completed structure. There are about 6,000 men

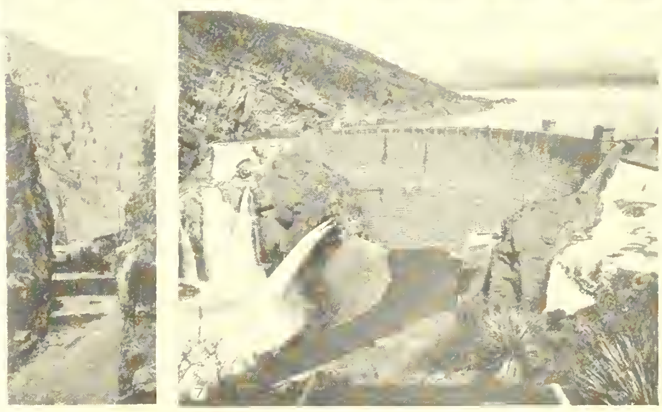




A Few Reclamation Structures







1. Truckee diversion dam, Newlands Project, Nevada. Completed June 1905.
2. Shoshone storage dam, Shoshone Project, Wyoming. A monolithic rubble concrete structure of arch type. Maximum height 328 feet. Completed January 16, 1910.
3. Arrowrock storage dam, Boise Project, Idaho, 353 feet high. Completed November 1915.
4. Owyhee storage dam, Owyhee Project, Oregon-Idaho, 417 feet high. Dedicated July 1932.
5. Boulder dam, Boulder Canyon Project, Arizona-Nevada. The highest dam in the world, 727 feet. Dedicated by President Roosevelt September 30, 1935.
6. Grand Coulee dam, Columbia Basin Project, Washington, now under construction. With almost 2,000,000 cubic yards of concrete already poured and excavation nearly completed. The magnitude of the structure can be obtained from this photograph.
7. Roosevelt dam, Salt River Project, Arizona. This storage dam is of rubble masonry with coursed rubble faces, laid in Portland cement mortar. Height 284 feet.

engaged in constructing cofferdams, excavating the bed of the river, and placing concrete in the river section of this immense structure. As with the Roosevelt, Arrowrock, and Elephant Butte Dams, it was necessary to do a considerable amount of pioneering in the way of building roads and railroads to the site and constructing model towns for the homes of those erecting this colossal structure.

Imperial Dam.—One of the most interesting dams under construction is the Imperial Dam on the Colorado River, which will serve as the intake for the All-American Canal on the California side and the Gila Canal on the Arizona side. The dam is a floating hollow-concrete structure about 50 feet in height, with a crest length of 3,500 feet and a volume of 217,000 cubic yards. In connection with this dam, desilting works are being constructed for removing the silt from water entering the canals, which has caused an expense of $1,000,000 per year in the past to the farmers in Imperial Valley.

At the present time the Bureau has 19 dams under construction, and the following table gives the percentage of completion:

Name	State	Bids opened	Percent of completion
Alamogordo	New Mexico	Dec. 21, 1935	80
Alcova	Wyoming	July 15, 1935	53
Bartlett	Arizona	May 16, 1936	13
Boca	California	Sept. 30, 1936	5
Bull Lake	Wyoming	Dec. 7, 1935	65
Caballo	New Mexico	Apr. 2, 1936	33
Cross Cut	Idaho	July 10, 1936	40
Parker	Arizona	July 26, 1934	62
Fresno	Montana	Oct. 30, 1936	10
Grand Coulee	Washington	June 18, 1934	22
Grassy Lake	Idaho	Aug. 7, 1936	20
Imperial	Arizona-California.	Nov. 21, 1935	63
Island Park	Idaho	Aug. 5, 1935	63
Marshall Ford	Texas	Oct. 20, 1936	20
Moon Lake	Utah	Feb. 4, 1935	60
Pine View	do	Sept. 5, 1934	98
Seminole	Wyoming	July 22, 1935	27
Taylor Park	Colorado	Feb. 18, 1935	60
Unity	Oregon	Nov. 30, 1935	16

These dams are giving employment to thousands of men and utilize large quantities of cement, steel, machinery, and other products from both eastern and western mills and manufacturing centers.

Engineering research.—In connection with the design and construction of these immense structures it was necessary to do a large amount of original research and investigational work. Laboratories for the testing of models of dams, spillways, and of earth, cement, and concrete aggregate were established, and a large number of technical memoranda dealing with all phases of the problems of dam construction, and the quality of materials utilized including cement and concrete were issued. Specifications were prepared for a low-heat type of cement and altogether there have been issued more than 1,700 specifications for the dams and appurtenant works, power plants, and irrigation canals and structures. An organization of approximately 800 engineers and technical experts is located in Denver under the supervision of the chief engineer, to design and supervise construction of these projects which are without precedent in the field of modern engineering. John L. Savage is the chief designing engineer.

During the 35 years of the life of this Bureau, there have been six directors or commissioners and but four chief engineers as follows:

Commissioners: Chas. D. Walcott (1902–1907), F. H. Newell (1907–1914), Arthur P. Davis (1914–1923), D. W. Davis (1923–1924), Elwood Mead (1924–1936), John C. Page (present commissioner, appointed January 25, 1937, by President Roosevelt).

Chief engineers: F. H. Newell (1902–1907), A. P. Davis (1907–1920), F. E. Weymouth (1920–1924), R. F. Walter (present incumbent, appointed by the Secretary of the Interior May 1, 1925).

A list of the dams exceeding 50 feet in height on the Federal projects constructed or under construction by the Bureau of Reclamation follows:

	Feet
Boulder	727
Grand Coulee	550
Owyhee	417
Arrowrock	353
Shoshone	328
Parker	320
Elephant Butte	306
Horse Mesa	305
Roosevelt	284
Bartlett	270
Seminoe	265
Marshall Ford	265
Alcova	232
Mormon Flat	229
Tieton	222
Pathfinder	218
Stewart Mountain	212
Taylor Park	200
Gibson	195
Black Canyon	183
McKay	165
Deadwood	160
Echo	155
Alamogordo	142
Stony Gorge	142
East Park	139
Cle Elum	135
Sun River	135
Lahontan	124
Grassy Lake	120
Boca	110
Cave Creek	109
Warm Springs	109
Belle Fourche	108
Guernsey	105

	Feet
Pine View	100
Cold Springs	98
Sherburne Lakes	98
Agency Valley	93
Caballo	90
Moon Lake	90
Gerber	88
Minidoka	86
Island Park	85
American Falls	85
Clear Creek	84
Milner	80
Unity	78
Fresno	77
Rye Patch	75
Bull Lake	75
Strawberry	72
Willow Creek	71
Willwood	70
Deer Flat	70
Keechelus	70
Thief Valley	70
Boise River	68
Conconully	67
Jackson Lake	67
Easton	66
Minatare	65
Kachess	63
Como	60
McMillan	57
Avalon	54
Elephant Butte Dike	50
Ralston	50
Imperial	50

Lake Mead, Largest Artificial Lake in the World

Enough water to supply the domestic needs of the entire population of the United States for more than 3 years has been stored in Lake Mead by Boulder Dam. John C. Page, Commissioner of Reclamation, reported to Secretary of the Interior Harold L. Ickes on May 5 that "Lake Mead now contains 11,000,000 acre-feet of water, a gain of 1,000,000 acre-feet in a month."

This man-made lake, the largest in the world, extends up the Colorado River 101 miles above Boulder Dam and covers 72,200 acres in what was once one of the most forbidding deserts on the North American continent. As Lake Mead grows, additional security is provided for the tens of thousands of irrigation farmers along the Colorado River below Boulder Dam in the Imperial Valley in southern California. Faced with continual danger of either flood or drought as the Colorado River fluctuated, these communities now are assured for all time of a regulated, continuous, and adequate water supply.

West needs further agricultural development

A striking illustration of the need for further agricultural development in the West by reclamation is found in a study of sectional increases in the population of the United States since 1910.

In 1910 there were in the United States 91,972,266 persons, while in 1930 there were 122,775,046, an increase of 33.5 percent; in 1910 there were in the Mountain States 2,633,517 and in 1930, 3,701,789, an increase of 40.6 percent; in 1910 there were in the Pacific Coast States 4,192,304 and in 1930, 8,194,433, an increase of 95.5 percent.

The significance of these figures becomes apparent when it is understood that only through irrigation can the agricultural areas which must support the increased population of the Mountain and Pacific Coast States be expanded.

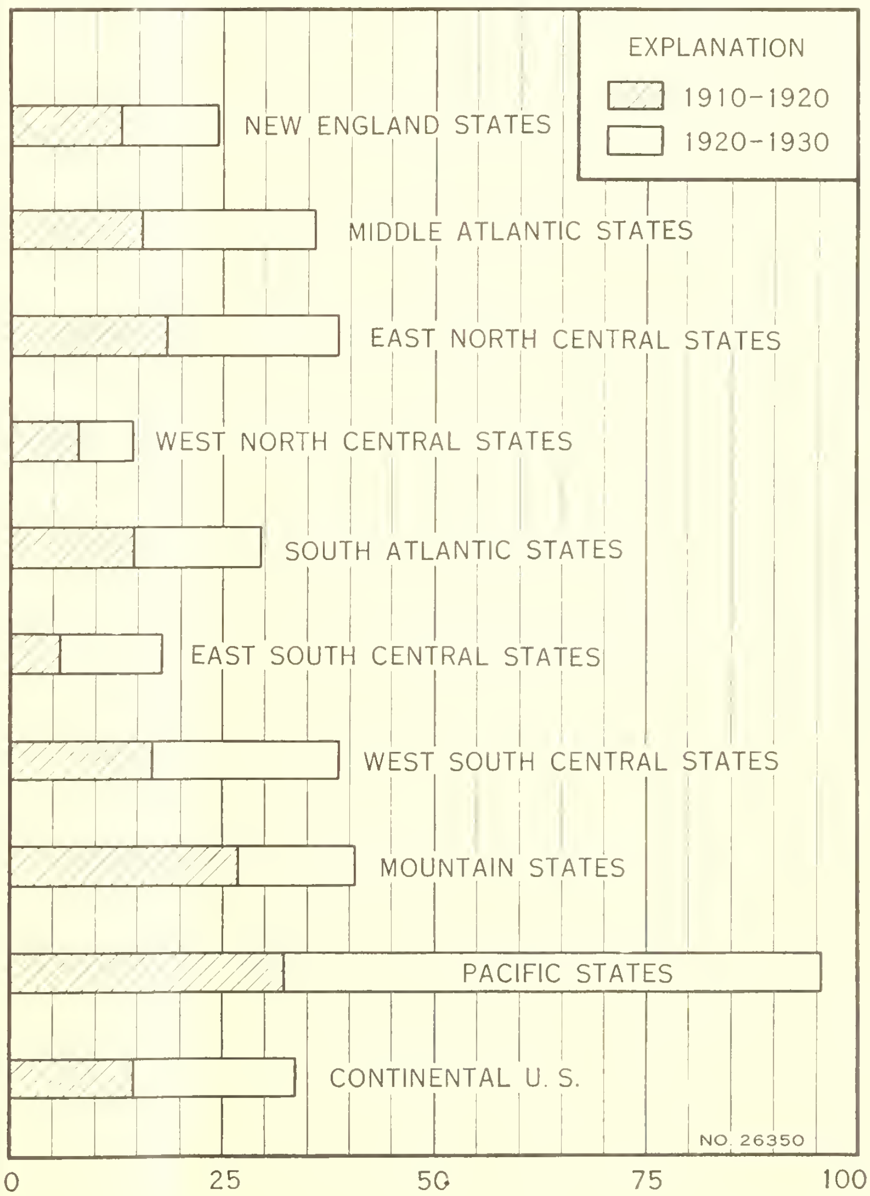
It has long been apparent that the West has been growing more rapidly than other sections of the country. It has also been apparent for a number of years that the agriculture of the West was not keeping pace with the population. More and more each year the great population centers of the West have been forced to depend for staple foods upon material shipped from east of the Rocky Mountains.

This places the western cities at a distinct disadvantage. In no other area is it necessary to transport foodstuffs 2,000 miles to supply the essentials of diet in any city. It is a strong argument for continuation of the Federal reclamation program, which is the only way in which the semiarid and arid West can be as a region made more nearly self-sufficient.

POPULATION OF THE UNITED STATES BY DIVISIONS

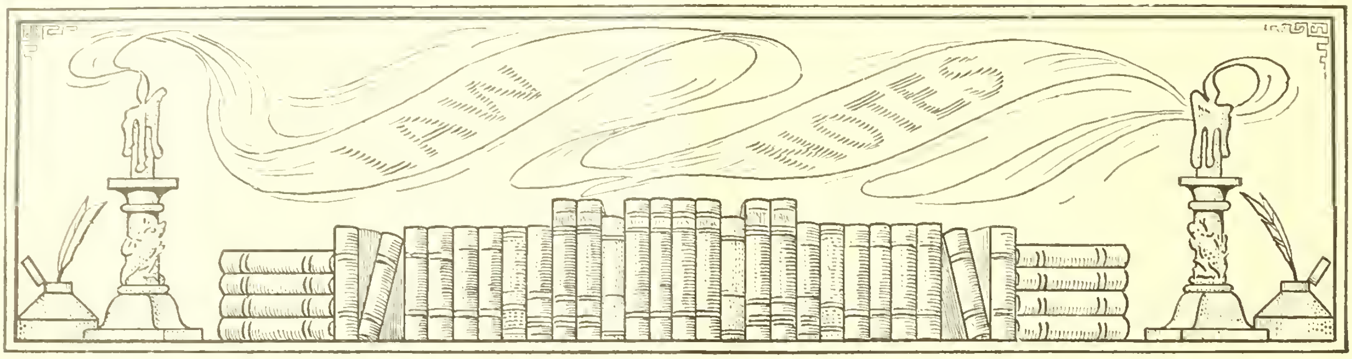
Division	1910	1920		1930	
	Total	Total	Percent increase	Total	Percent increase
New England	6,552,681	7,400,909	12.9	8,166,341	24.6
Middle Atlantic	19,315,892	22,261,144	15.2	26,260,750	36.0
East North Central	18,250,621	21,475,543	17.7	25,297,185	38.6
West North Central	11,637,921	12,544,249	7.8	13,296,915	14.3
South Atlantic	12,194,895	13,990,272	14.7	15,793,589	29.5
East South Central	8,409,901	8,893,307	5.7	9,887,214	17.6
West South Central	8,784,534	10,242,224	16.6	12,176,830	38.6
Mountain	2,633,517	3,336,101	26.7	3,701,789	40.6
Pacific	4,192,304	5,566,871	32.8	8,194,433	95.5
United States, continental	91,972,266	105,710,620	14.9	122,775,046	33.5

PER CENT IN GROWTH OF POPULATION OF THE UNITED STATES FROM 1910 TO 1930



Visitors to Boulder Canyon

On April 1 the National Park Service started three checking stations, one on the Las Vegas Highway, one on the Kingman (Ariz.) road, and one on the road to Lake Mead. During the month 53,804 persons traveling in 19,167 cars were checked through the Arizona and Nevada gates; 12,323 persons in 4,080 cars passed the Lake Mead checking station to visit the beach and boat docks; of the number entering the Boulder Dam—Boulder City district—a small number may be considered to be local cars. One thousand seven hundred and eleven persons in 556 cars visited the Overton and Pierce Ferry districts. Every State, except Vermont and South Carolina, three Territories, and three foreign countries were represented



Controlling Harmful Land Speculation on Reclamation Projects

THE decision of Judge Charles W. Ellis of the Circuit Court of Malheur County, Oreg., in *Terra v. Pinney and Owyhee Irrigation District, No. 4829 E*, and *Pfeiler v. Greig and Owyhee Irrigation District, No. 4833 E*, rendered January 27, 1937, discussing the contracts of the Bureau aimed at throttling harmful speculation in the irrigable lands of the Owyhee project, is of such interest and involves a matter of such novelty, that it is quoted in full below:

OPINION ON DEMURRERS

"The above-entitled two causes were combined for argument of the demurrers; and as the same questions, as to all purposes of the demurrers, are involved in each of the causes, the following opinion shall stand as the opinion in each of said causes."

Each of said causes was initiated by the filing of a petition for declaratory judgment. The facts on which said request are based are, substantially as follows:

Under the Reclamation Act of the United States (act of June 17, 1902, 32 Stat. 388, and acts amendatory and supplemental thereto) the United States of America, acting through its First Assistant Secretary of the Interior, and the Owyhee irrigation district, a quasi-municipal corporation, organized and existing under and by virtue of the irrigation district laws of the State of Oregon, entered into an agreement on October 14, 1926, which agreement involved the construction, etc., of the Owyhee project in Malheur County, Oreg., from Reclamation Act funds. The said agreement defines what are therein denominated "new lands", and that such lands are to be appraised, and that upon the sale of any such "new lands" all consideration over 50 percent of the incremented value shall be paid by the vendor to the district, or the vendee shall pay to the district out of money which otherwise have been payable to the vendor, and which payment to the district shall be credited to "such tract of land so transferred as an advance payment of future construction and operation and maintenance charges." (See exhibit A to petitions—being copy of the agreement between the United States and the irrigation district—par. 41, especially subdivisions I and J.)

Of course, the irrigation district is obligated to pay to the United States of America the cost of the Owyhee project. The agreement also provides for the refusal of water in case of default in payments, in a detailed way throughout the agreement; which commits the United States of America to the advancement of $18,000,000. The agreement as copied into the exhibit A, to the petitions, contains 41 pages, but it is not necessary to comment on but several of the provisions for any purpose of this opinion.

In the explanatory recitals (par. 2 of agreement) it is set forth:

(Sub. 3) "Whereas, the District desires the United States to construct for its benefit certain irrigation works;" and

(Sub. 4) "Whereas, to insure repayment to the United States of the money to be expended by it under this agreement, it will be necessary to provide for the disposition of the proceeds in excess of an appraised valuation, from the sale of lands within the District:";

and paragraph 33, provides, among other things, that should any assessment, or assessments, authorized by the terms of the agreement and levied against any tract of land in the district be held illegal or void, or the district or its officers be enjoined or restrained from making or collecting any assessments provided for from any tract of land in the district at the instance of the owners or holders of such tract of land, then such tract shall have no right to any of the benefits of this contract and no water furnished through any works constructed by the United States shall be delivered to or for such tract or tracts of land until construction and operation and maintenance charges at the rates and upon the terms and conditions provided for herein shall have been paid by the landowner to the district, and by the district to the United States, etc. Also the agreement provides, in this paragraph 33, that the payment of construction and operation and maintenance charges at the rates and upon the terms and conditions provided for herein is a prerequisite to the right to receive water from any of the works constructed by the United States and no irregularity in levying assessments by the district, or lack of authority in the district, or in the board of control, whether affecting the validity of district assessments or not, shall be of any effect to authorize any land owner of the district to demand or receive water made available through irrigation works constructed by the United States unless construction and operation and maintenance charges at the rates and upon the terms and conditions provided herein have been paid by such landowners.

As hereinbefore stated paragraph 41—subdivisions I and J—among other things provides:

(I) "If any of the lands of the district are sold at an incremented value, as defined in subdivision B of this article, the vendor shall pay to the district, or the vendee shall pay to the district out of the money which would otherwise have been payable to the vendor, an amount equal to 50 per centum (50%) of such incremented value."; and also

(J) "Such payment shall be credited on the books of the district to such tract of land so transferred as an advance payment of future construction and operation and maintenance charges—"; and

(N) "Adjudication of invalidity of articles 41 and 42 of this contract, or any part of said articles, shall not impair or otherwise affect the validity of any other of the articles hereof; *Provided, however*, That the Secretary may refuse to proceed with this work of constructing the project if such articles are adjudicated to be invalid.";

And subdivision P of paragraph 41 provides for the examination of land transfers, by monthly inspections, to the end of enforcing the provisions of the agreement.

Paragraph R thereof provides for an annual showing in such regard.

Paragraph 48 of the agreement provides:

"The execution of this contract shall be authorized by the qualified electors of the district at an election held for that purpose. Thereafter, without delay, the district shall prosecute to decree proceedings in court for a judicial confirmation of the authorization of this contract. This contract shall not be binding until a confirmatory final judgment in such proceedings shall have been rendered, including final decision on any appeal prosecuted therefrom. The district shall furnish the United States for its files certified copies of all proceedings relating to the organization of the district and to the election upon the contract." and

Paragraph 32 of the agreement provides:

"Every landowner of the district who offers no objection to the confirmation of this contract by the court, or the proceedings authorizing the same, or who accepts the benefits thereof by receiving or using water made available through the works constructed by the United States, thereby consents to all the provisions of this contract and waives any objection thereto."

Paragraph 41 of the agreement contains the following provision, not hereinbefore specifically mentioned, viz:

(A) "No part of the water supply provided through the canal system constructed under the provisions of this contract shall be delivered to or for any new lands or excess lands except lands in this district and other districts or organizations of the Owyhee project making similar contracts whose owners, or their heirs, successors, and assigns, have executed and delivered recordable contracts in a form to be approved by the Secretary, accepting the terms and conditions of this contract, and agreeing that their lands shall be bound by all the terms and conditions of this contract, and particularly the terms set out in this article;—."

which is the article providing for disposition of moneys over the appraised value on sale of new lands.

Under the provisions of this last quoted paragraph the "recordable contracts" were approved and executed. (See petitions—exhibits D and E—the latter being short forms adopting the initial and larger forms.)

The "recordable contracts", exhibit D, at paragraph 6, provides:

"The provisions of said article 41 shall be impressed upon the title to said above described land as covenants duly undertaken by the owner of said land and covenants running with the title to said land."

and paragraph 7 binds the contractor (1 and owner) to the disposition of the portion of the incremented value of the selling price; and paragraph 8 makes the portion to be paid to the district (being a proportion of the amount received by the grantor over the appraised value) a lien in favor of the district, which lien may be foreclosed as a mortgage; and paragraph 9 provides that the district may transfer, set over, or assign the lien to the Secretary of the Interior; paragraph 10 is to the effect that if the lien provided for should be held null and void or unenforceable, then any and all sales and transfers of the land shall be null and void and of no force and effect unless at the time of such sale or transfer, or prior thereto, there shall have been paid to the district the amounts provided for in article 41 of the contract of October 14, 1926 (being ex. A to the petition); and paragraph 12 provides:

"The remedies herein provided are not to be construed to impair or interfere with any other remedy available to the district or the United States for the enforcement of the payments provided for herein or in said contract of October 14, 1926, but are in addition to such other remedies, as would otherwise be available and all other remedies, including the remedy of withholding delivery of water, are reserved to the district and the United States."

and the closing paragraph, 13, is that the agreement binds the heirs, successors, and assigns of the parties.

The foregoing references and quotations from the contracts are comprehensive enough to understand the issues raised by the proceeding and the demurrers; except, perhaps it should be said that "excess lands", conditions met, come under paragraph 41—see paragraph 42.

The brief of the defendants Greig and Pinney states that there is nothing in the Federal act authorizing the insertion of any such provision as article 41 of the Owyhee contract. Section 423e of title 43, U. S. C. A., 1936 Cumulated Annual Pocket Part (being act of May 25, 1926, ch. 383, sec. 46, 44 Stat. 649), provides, among other things:

"No water shall be delivered upon the completion of any new project or new division of a project initiated after May 25, 1926, until a contract or contracts in form approved by the Secretary of the Interior shall have been made with an irrigation district or irrigation districts organized under State law providing for payment by the district or districts of the cost of constructing, operating, and maintaining the works during the time they are in control of the United States, such cost of constructing to be repaid within such terms of years as the Secretary may find to be necessary, in any event not more than 40 years from the date of public notice hereinafter referred to, and the execution of said contract or contracts shall have been confirmed by a decree of a court of competent jurisdiction. * * * Such contract or contracts with irrigation districts hereinbefore referred to shall further provide that all irrigable land held in private ownership by any one owner in excess of 160 acres shall be appraised in a manner to be prescribed by the Secretary of the Interior and the sale prices thereof fixed by the Secretary on the basis of its actual bona fide value at the date of appraisal without reference to the proposed construction of the irrigation works; and that no such excess lands so held shall receive water from any project or division if the owners thereof shall refuse to execute valid recordable contracts for the sale of such lands under terms and conditions satisfactory to the Secretary of the Interior and at prices not to exceed those fixed by the Secretary of the Interior; and until one-half the construction charges against said lands shall have been fully paid no sale of any such lands shall carry the right to receive water unless and until the purchase price involved in such sale is approved by the Secretary of the Interior and that upon proof of fraudulent representation as to the true consideration involved in such sales the Secretary of the Interior is authorized to cancel the water right attaching to the land involved in such fraudulent sales; * * *."

Section 423f of title 43, U. S. C. A., 1936 Annual Cumulative Pocket Part, page 44, reads as follows:

"The purpose of sections 423 to 423g of this title is the rehabilitation of the several reclamation projects and the insuring of their future success by placing them upon a sound operative basis, and the Secretary of the Interior is directed to administer said sections to those ends." (May 25, 1926, ch. 383, sec. 48, 44 Stat. 650.)

Under Oregon law the authority for the irrigation district to enter into the agreement (exhibit A to petitions) is found in the last paragraph of section 48-208, Oregon Code, which paragraph reads as follows:

"And the board shall likewise have authority to enter into any obligation or contract with the United States for the construction, operation, and maintenance of the necessary works for the delivery and distribution of water therefrom under the provisions of the act of Congress of December 5, 1924, entitled 'An act making appropriations to supply deficiencies in certain appropriations for the fiscal year ending June 30, 1924, and prior fiscal years, to provide supplemental appropriations for the fiscal year ending June 30, 1925, and for other purposes' and in such contract to provide for payment of charges to the United States upon the basis authorized by said act of Congress of December 5, 1924, which is commonly known as the Fact Finders' Act, and under such rules and regulations as may be promulgated to and by the reclamation service of the United States."

The Reclamation Act is constitutional; and apparently the amendments thereto are likewise so under the decision in *United States* v. *Butler*, 297 U. S. 1; 80 L. Ed. 477; 102 A. L. R. 914. The United States, as to the Owyhee project, was about to commit itself to the payment of some $18,000,000; and the Secretary of the Interior, in his judgment, had inserted in the contract with the district this very explanatory clause;

"Whereas, to insure repayment to the United States of the money to be ex-

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pended by it under this agreement, it will be necessary to provide for the disposition of the proceeds in excess of an appraised valuation, from the sale of lands within the District."

The theory of the Reclamation Act is not that the projects to be built are to be a gift, but that they shall be paid for and the United States be reimbursed. By the amendment of May 25, 1926, as to all projects initiated after said date, the Secretary of the Interior was directed to approve a form of contract, with a district or districts, providing for payment by the district or districts of the cost of constructing, operating, and maintaining the works during the time they are in control of the United States, such cost of constructing to be repaid within such term of years as the Secretary may find to be necessary (not to exceed 40 years from the date of public notice), and the execution of said contract or contracts to be confirmed by decree of a court of competent jurisdiction. This section of statute (43 U. S. C. A. 423 e) makes an absolute requirement that all lands held by one individual owner in excess of 160 acres shall not be entitled to water except that a recordable (and valid) contract be executed providing for appraisement of the excess land (over 160 acres) and a sale price to be fixed by the Secretary. As to such excess lands the Secretary wrote the statutory provision into the contract with the Owyhee district. The present proceedings involve "new" lands. The statute cited made the absolute requirement as to "excess" lands, and perhaps not exactly specific, as the language of the statute is "under terms and conditions satisfactory to the Secretary of the Interior and at prices not to exceed those fixed by the Secretary of the Interior." Now the Secretary had placed in the agreement (exhibit A to petition) substantially the same provisions as to sales of "new" lands as to "excess" lands.

If the statute be doubtful or ambiguous (and it cannot be overlooked that the Secretary was authorized to contract as to a matter involving up to $18,000,000 of public funds and for the insuring the financial stability and responsibility of the project to the end that the United States would be repaid) the rule seems to be that a practical construction by the executive officers, who are charged with the execution, if long acted upon and generally acquiesced in, is regarded as strong evidence of the true meaning of the law; and although it is not binding upon the courts, they will not interpret the law differently unless there are weighty reasons for so doing.

Black on Construction of Laws (2d ed.) page 300.

The Secretary of the Interior was authorized to contract in form to be approved by him, and the execution of the form of contract was to be confirmed by decree of a court of competent jurisdiction. Probably each project constructed from Reclamation Act funds has some features different from others which requires a different form of contract. The writer of this opinion does not know whether the provision in the Owyhee contract, involved herein and objected to, is in other project contracts. However, it is known that this contract involved was executed October 14, 1926—some 10 years ago—and that it was approved by an Oregon court, and that under this contract the United States has expended substantially up to $18,000,000. The Secretary insisted on the provisions for the protection of the United States, and unless the provisions had been approved in the several ways required the project probably would not have been built. The Secretary, on behalf of the United States, would seem to have the right to insert provisions to forestall speculation in units of acreage, especially as to lands, probably whose very value depended upon the construction of the project. In insisting on the provision complained of there was not duress any more than there has been duress involved in innumerable public projects. Nor is the provision inequitable, as it would be much more inequitable for the United States to spend the public moneys to foster speculative value and profit for a few individuals which might endanger the integrity of the project, than to provide against speculation so that the owners under the project would not be encumbered by any original capital charges which might jeopardize the advances of the United States.

A State court in Oregon, this very court, approved the contract by confirming it, and it would be strange, indeed, if in this same court the objections raised as against the contract by the defendants Pinneys and Greigs were countenanced; and the law is that they cannot be.—(*To be continued in the July issue.*)

Edward M. Philebaum Dies

Edward M. Philebaum, retired employee of the Bureau of Reclamation at Yuma, Ariz., died on April 25 as the result of a stomach operation.

Mr. Philebaum entered the Government service with the Weather Bureau in July 1882, subsequently being engaged with the United States Engineers' Corps in construction of coast defenses and spending sometime in Alaska in the construction of lighthouses. He entered the employ of the Bureau of Reclamation in April 1906, and was assigned to the Yakima project, Washington.

All of Mr. Philebaum's service with the Bureau was on the Yakima and Yuma projects, with the exception of a short period spent in the Denver office. He was transferred from Denver to Yuma in February 1916 and was continuously employed on the Yuma project until his retirement at the close of January 31, 1932. During the greater part of his long period of service with the Reclamation Bureau, Mr. Philebaum acted as fiscal agent, and all of his service on the Yuma project was in that capacity.

A widow and two daughters survive Mr. Philebaum. Since his retirement in 1932 his home has been in Los Angeles.

THE Willwood Home Beautification Club (Shoshone project, Wyoming) had its annual tree and shrubbery planting days on April 20 and 21. Shrubbery and evergreens were obtained on a shrub-gathering tour in the mountains. Practically all of the Willwood settlers belong to this club, and the knowledge gained by members has greatly improved the appearance of farm homes on this division.

REPORTS from users of motion pictures indicate that during the month of April reclamation films were shown 65 times before audiences totaling 6,287 persons.

THE first annual meeting of Pacific Northwest Fruits, Inc., which represents four fruit cooperative organizations in the Northwest, was held in Yakima during the month of April. The organization reported a favorable year.

CONSTRUCTION of a $40,000 freight terminal for Consolidated Freight Lines was started in Yakima early in April. The structure is to be of concrete, with one story and basement storage space and modern dock equipment. Company officials report a steadily increasing motor freight tonnage.

WORK on a two-story addition to the warehouse of the Cowiche Fruit Growers, Inc., at Cowiche, Washington (Yakima project), estimated to cost $38,000, has been started. Storage capacity of the plant will be increased 70 percent by the addition. Cold storage equipment will be added later.

Machinery Gives More Jobs Than it Takes

MODERN machinery has given more jobs than it has taken, is the assertion, backed by statistics, by R. E. W. Harrison, chief of the machinery division, Bureau of Foreign and Domestic Commerce, Washington, speaking recently before a gathering at the University of Tennessee.

In sustaining this conclusion Mr. Harrison stated:

"There has been a consistent effort during the depression to discredit and restrict the progress of mechanization on the ground that it is a breeder of unemployment. Although it is obvious that a given machine may tend to eliminate hand labor, often in a spectacular way, the machine year by year contributed to a larger volume of national employment until the crash of 1929, which was due to financial rather than technological factors. Increased mechanization now is not a barrier to reemployment but is one of the ways out of the depression.

"The American standard of living is measured by the use of machinery. This is illustrated statistically by an increase in the number of gainfully employed, from 38 millions in 1910 to 49 millions in 1930, a net gain of 11 millions of workers. However, during the same period, farm workers actually decreased from 12½ millions in 1910 to 10½ millions in 1930, a loss of 2 millions, and industrial workers increased from 11½ millions in 1910 to 15½ millions in 1930, a gain of 4 millions. Of still more importance, service workers increased from 14 millions in 1910 to 23 millions in 1930, a net gain of 9 millions, two-thirds of which occurred in the past decade."

In view of a too common, and sometimes tragic, belief on the part of people high in public life that use of machinery decreases employment, the reader is urged to read carefully the factual article here reproduced from "Steel."

It is another convincing exhibit in the overwhelming evidence against the economic advisability of wholesale substitution of day labor or "Chinese coolie" methods for modern construction methods.—Editor's Note.

The growth of service employment, he said, is due principally to the development of the machine, which has made it possible for so many people to enjoy in a 20-year period enough of life's goods to employ an additional army of 9,000,000 workers to distribute and service them.

PRODUCTION TREND CLIMBING

As to mechanization, Mr. Harrison pointed to the steadily rising trend line of industrial production employment and pay rolls, interrupted only by the debacle of 1929, which he attributes to faulty financial procedure which dislocated all activities, in which broad economic causes were the actuating force, and in which mechanization as a cause of unemployment has no participation.

The machinery industry, he pointed out, rates second in number of employees, fifth in the number of establishments engaged in industry, and fourth in value of its products. In 1929 it produced $7,000,000,000 worth of products, 10 percent of the total turned out by all industries.

The automobile industry, probably the most highly mechanized in the world, is outstanding as far as recovery (as measured by furnishing reemployment) is concerned.—*Pacific Builder and Engineer.*

Progress of Investigations of Projects

Blue River transmountain, Colorado. All field work was discontinued. Run-off records were extended to cover the period 1900 36, and studies are being made to determine run-off of tributary streams for which no records are available.

Colorado-Big Thompson, Colorado.—The studies of water supply and power output of the several power plants and economic studies were completed, and the final report was finished.

Eastern slope, Colorado—(*a*) *Cherry Creek surveys.*—A preliminary geological report of the dam site and reservoir formations, which contains recommendations for diamond drilling, was completed. Two diamond drill rigs were set up on the Cherry Creek project, one at the upper dam site and the other at the site of the washed out Castlewood Dam.

(*b*) *Trinidad irrigation and flood control.*—Topographic surveys of the dam site on the Purgatoire River were begun.

(*c*) *Hugo flood-control surveys.*—A topographic survey has been completed of the area surrounding the diversion site. During the month, 23 test holes were dug in the vicinity of the reservoir and diversion sites.

(*d*) *North Republican River surveys.*—Topographic surveys were completed on a reservoir and dam site located about 3 miles southwest of Wray. To date, 32 test holes have been dug.

(*e*) *Arickaree River.*—Cross-sections were taken at the dam site for the purpose of making an estimate of the earthwork required for a dam on the river about 7 miles northwest of Idalia, Colo.

(*f*) *Apishapa irrigation reconstruction.*—Camp was established on the east bank of the river near the site of the project, where topographic surveys will be made at the location of the dam washed out in August 1923.

(*g*) *Huerfano Canyon irrigation and flood control.*—Topographic surveys were about 85 percent completed on a reservoir site located on the Huerfano River in the vicinity of Mustang, Colo.

(*h*) *Cucharas silt survey.*—The silt survey of the Cucharas Reservoir located on the Cucharas River about 15 miles northeast of Walsenburg was completed.

Western slope, Colorado—(*a*) *Collbran project.*—Stream gages were established on a number of streams in the area.

(*b*) *Mancos Valley project.*—The final water-supply studies and the supplementary reservoir-operation studies were completed. The final draft of the report on the Mancos project was completed.

(*c*) *Piceance project.*—A stream gage was established and the flow measured on Piceance Creek. A preliminary reconnaissance was made.

(*d*) *Roan Creek project.*—A gaging station was established on the Kimball Creek and obervations were made of the Dry Fork of the Roan.

(*e*) *Silt project.*—Gaging stations were established on East Elk and West Elk Creeks.

(*f*) *Troublesome project.*—Stream gages were established and the flow measured on the Main Troublesome and East Troublesome Creeks.

(*g*) *West Divide Creek project.*—Gaging stations were established on West Mamm, Middle Mamm, East Mamm, Alkili (branch of West Divide Creek) and West Divide Creeks.

(*h*) *Yampa project.*—Work was begun on the cost estimates of the feeder canal to Watson and Hunt Creeks.

(Continued on p. 137)

Interesting Construction at Horse Mesa Dam

By Richard T. Larsen, Associate Engineer, Salt River Project

ONE of the most spectacular and difficult jobs ever undertaken by the Bureau is the spillway job at Horse Mesa Dam, on the Salt River, in Arizona. Down in a canyon half a mile deep, a narrow gorge flanked by high and almost vertical cliffs, the scene is one of rare color, beauty, and majesty. Scenic grandeur, yes, but also perplexing problems for the engineer and construction man.

Horse Mesa Dam is 305 feet high, and all of the construction work is being done with practically a full reservoir. This called for extreme caution in doing the excavation work, and also made it impossible to work from the upside, except by barges. The power plant with a capacity of 43,000 horsepower is located directly below the dam, and it was necessary to operate this plant throughout the job. All construction features had, therefore, to be carefully timed to fit reservoir levels which would not interfere with power production. This latter condition made it necessary to build a cofferdam 60 feet high in the approach channel for the tunnel to permit completion of the tunnel and the installation of the big 40 by 44.5-foot fixed wheel gate.

The work at Horse Mesa consists of altering present spillways and providing additional capacity of 50,000 cubic feet per second. It includes such features as a large diameter tunnel from which the water will discharge at express train speed; the fitting in of a 60-foot wide by 160-foot high headgate structure at the base of an overhanging cliff 450 feet high, the rebuilding of present spillways, together with new aprons on the faces of the near vertical cliffs in such fashion that the water will leap clear of the cliffs to the river, more than 250 feet below. Other minor but important features include the excavation and plugging with concrete of certain caves near river level and under the vertical cliff which forms the south abutments; and considerable grouting of the foundation rock and exploratory diamond drilling to determine the leakage under the dam.

LOCATIONS

Horse Mesa Dam on the Salt River some 60 miles northeast of Phoenix is reached by the scenic Apache Trail Highway, so named because of its proximity to the ancient and historic thoroughfare of the Apache Indians. For the first 20 miles, the modern surfaced road is flanked by the citrus groves and cotton fields of the Salt River project—indisputable evidence of the fertility of the desert land when systematic irrigation is applied to it. Crossing the well-defined boundary of the project, the trail traverses the dry but interesting and colorful desert which is dominated by Superstition Mountain standing guard over the legendary Lost Dutchman Mine. At the base of this mountain the trail leaves the pavement and, entering the Tonto National Forest, winds up the mountain slopes, at times skirting the magnificent gorge of the Salt River. In this gorge man-made dams have changed what was once a rushing stream into a series of quiet reservoirs which store the precious irrigation water. Incidentally, this water is fresh despite the name of the river. Continuing upriver, the trail arrives at the rim of Fish Creek Canyon, a main tributary of the Salt River.

Here the first difficulty or obstacle presents itself even before the site of the job has been reached. Leaving the trail at this point, the 6-mile service road to Horse Mesa Dam descends, or rather drops into the 3,000-foot chasm of Fish Creek Canyon in 4 miles of narrow tortuous curves and switchbacks, emerging at the junction of Fish Creek and the Salt River about 2 miles below the dam. In places the service road is no more than a ledge above a vertical drop of hundreds of feet. Although the curves in the road were widened where possible, before work at the dam was commenced, the delivery of manufactured materials, trucked 45 miles from the nearest railroad, is a complicated task. Concentrating on a safe descent, the natural beauties and awe-inspiring depths of the canyon are often overlooked, to be discovered only when the drive becomes a habit.

Rounding a bend in the river a half-mile downstream from the dam, the immensity of nature's handiwork is realized by comparison with Horse Mesa Dam which is by no means a small structure. Here, the Salt River gorge is comparatively narrow with a series of vertical and sometimes overhanging cliffs rising almost 3,000 feet to the plateau or mesa for which the dam is named. The apparent changelessness of the present-day canyon tends to obscure the changes wrought by gigantic natural forces during the untold ages that occupied the making of this mighty gorge. Three distinct kinds of rock are visible—dark diabase near the bottom of the gorge, immensely thick layers of pinkish andesite and a capping of sedimentary rock at the canyon rim. The diabase and andesite were formed by the solidifying of separate and successive flows of molten volcanic rock, after which the land level was lowered by other forces of nature. On the bottom of an inland sea that covered the depressed area, the sedimentary rock was deposited and in due time the land rose to the present level of the canyon rim. Since that last earth movement, the erosive forces of tremendous volumes of water have carved the deep gorge, the lower portion of which has been blocked by man's handiwork—a dam.

After a contemplation of the grandeur of the scene, closer inspection reveals the second obstacle which presented itself before construction work could proceed. The narrow canyon and steep river banks offered very little space for the erection of a construction camp and work plant. By locating the camp on stilts along the river bank, quarters for 250 men were provided, and the plant and storage yard somehow arranged themselves on the small available area of nearly level ground.

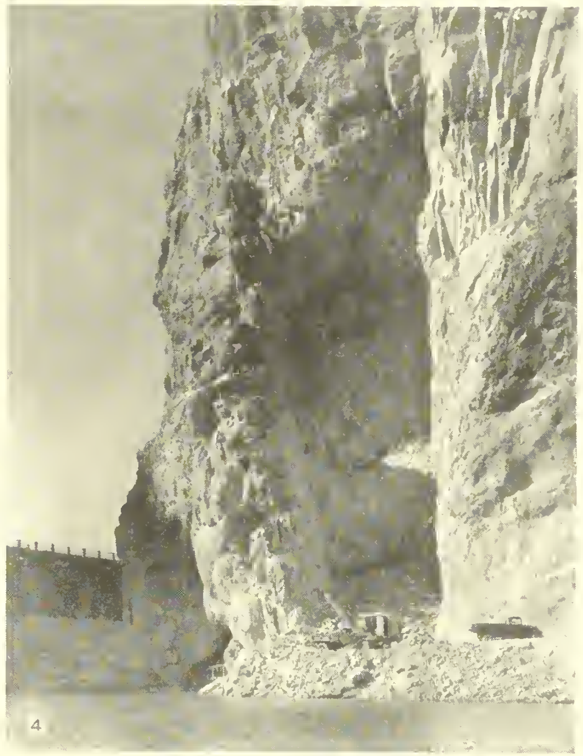
HISTORY

As a preface to the description of work in progress, a short history of Horse Mesa Dam will explain the reason for the work.

HORSE MESA DAM

SALT RIVER PROJECT, ARIZONA

1. Upstream side. Canyon of the Salt River in background.
2. Inside 34-foot diameter auxiliary spillway tunnel showing top heading and bench method of excavation.
3. Right spillway of dam, showing construction of new aprons, partially completed.
4. Excavation for approach channel and regulating gate structure, auxiliary spillway tunnel.
5. Dam from the downstream side. Work in progress on left spillway, and the new spiral stairway under construction-extreme left. A portion of the power house is visible.



Horse Mesa Dam and power plant is one of a series built and operated by the Salt River Valley Water Users' Association for the storage of irrigation water and the generation of electric power. The dam is a plain concrete structure of the variable-radius thin-arch type, 305 feet high, 57 feet thick at the base, 8 feet thick at the top, and is 784 feet long, measured along the crest. Six radial gates at the north abutment and three radial gates at the south abutment of the dam, each 27 feet long and 23 feet high provide a controlled spillway for the discharge of flood waters or the by-passing of irrigation water. The power plant at the toe of the dam has a capacity of 43,000 horsepower under a head of 266 feet. The construction of the dam and power plant by the association was completed in 1927.

After completion a number of undesirable conditions became apparent with the operation of the dam and power plant. Perhaps the most important was the discovery that the overflow spillways, with a designed discharge capacity of 150,000 cubic feet per second, were capable of discharging only 90,000 cubic-feet per second owing to their position with respect to the approach channels. When discharging, the water from these spillways flowed down the short aprons, and, striking the rocks near the bottom of the canyon, was deflected in such a manner as to completely drench the substation on top of the powerhouse. Also, when the reservoir level was below the elevation of the spillway crests it was impossible to by-pass necessary irrigation water other than through the turbines in the powerhouse. This condition often made it necessary to waste excess generated power by discharging it into the river below the dam by means of a "water rheostat." Lastly, with only one hoisting motor on each spillway, it was impossible to operate more than two gates at a time and then only at a very slow rate of speed.

To remedy these conditions at Horse Mesa Dam and unsatisfactory conditions at the other dams on the Salt River, the Water Users' Association entered into a contract with the United States, whereby the Bureau of Reclamation would recondition the existing Salt River dams and build Bartlett Dam on the Verde River as a Federal Works Progress Administration project, the cost to be repaid by the association. The contract for the work at Horse Mesa Dam was awarded to L. E. Dixon Co., Bent Bros., Inc., and Case Construction Co., Inc., Alhambra, Calif., on their joint bid of $712,976. Work was started on August 26, 1936, with a time limit for completion of 365 days.

HIGH-SCALING

After the preparatory operations previously mentioned, the construction work commenced with the scaling of loose rock from the canyon walls in areas where falling rock would be a hazard to future operations. During the scaling of the south canyon wall a large mass of detached rock 300 feet above the river weighing approximately 7,000 tons was successfully and safely deposited in the gorge downstream from the powerhouse with a charge of 800 pounds of powder.

AUXILIARY SPILLWAY TUNNEL

Because the high and vertical cliffs at the abutments of the dam made it impossible to alter the approach channels to the existing spillways, it was decided to build an auxiliary spillway tunnel around the north abutment of the dam. The tunnel is 520 feet long, 30 feet in diameter, and the outlet is 150 feet below the gate sill. The flow of water will be controlled by fixed wheel gate 40 feet wide and 44½ feet high. Besides providing 50,000 cubic-feet per second discharge capacity in time of flood, the tunnel will be used to release necessary irrigation water. Excavation of the tunnel was begun at the lower end, and, because of the sound character of the rock, was carried on without timbering. However, blasting to the line and grade and also the proximity of the dam abutment required the judicious use of blasting materials.

The gate structure at the tunnel inlet is 60 feet wide and 160 feet high and is situated at the base of a cliff some 450 feet high. The cliff rock is generally massive, and on the face, it is somewhat altered and is cut by deeply weathered vertical joints with a tendency to slab off in large masses. But directly above the gate structure the rock is fresh and hard and lies in thick massive near level layers which overhang the structure by 40 to 50 feet. And because of these extraordinary conditions, the safe location of the gate structure required more than ordinary foresight and confidence in the cliff rock. Excavation has now been completed; the structure will be well under the face of the cliff in fresh hard rock, and our concern as to its safety has been relieved.

Disposal of the rock from the gate house excavation presented another difficulty as dumping it in the lake so near the dam might cause the penstocks in the bottom of the dam to become blocked. with no road on the north side of the reservoir above the dam, a power shovel and three trucks had to be ferried over on a barge and operated on a quarter-mile road along the water's edge. After the tunnel was "holed through" this equipment was lowered down the steep slope of the tunnel without incident.

COFFERDAM

To meet irrigation and power demands, the reservoir water surface, which had been lowered 60 feet to permit the gatehouse excavation, had to be raised immediately following the excavation. Therefore, it was necessary to construct a concrete arch cofferdam in the short approach channel to the gatehouse, so that the tunnel and gate structure could be completed. The cofferdam has a center line radius of 30 feet, a thickness (for the entire height of 1 foot, and a total height of 57 feet. The temporary nature of the structure required construction in half-arch segments 4 feet high with provision for removal when the fixed wheel gate is in place.

EXISTING SPILLWAYS

Laboratory tests on models and experiments on the existing overflow spillways indicated that their combined capacity could be increased to 100,000 cubic feet per second by measures which would also remove the objectionable discharge conditions near the powerhouse. Based on information obtained from the models the spillway pier noses have been rounded and new ogee aprons constructed on the downstream side of the crests. Supported in some places by pier walls 40 feet high anchored to the faces of the canyon, the new aprons will cause the water to leap clear of the canyon walls and drop 200 feet directly into the river, well below the powerhouse.

With the powerhouse, substation, and two 110,000-volt circuits almost directly below, blasting the rock excavation for the new spillway aprons was a very precise operation. A large portion of the "shooting" was done beneath nets woven from steel cables.

The radial gates and hoists have been reconditioned and individual electric motors, hoisting mechanisms, and gate-position indicators have been installed. Power for these motors and also for the operation of the fixed wheel gate in the tunnel will be supplied by two gasoline, engine-driven, direct-current generators located in a small house at the north end of the dam.

All the work on the upstream side of the spillway gates was completed by the time the rising water reached the crests and the gates now are holding back their full head of water while work proceeds on the spillway aprons.

To stop harmless but unsightly seepage through the rock beneath the spillways, curtains of 1½-inch diameter holes, 100 feet deep, have been drilled on the up-

stream side of the crests, and cement grout forced into them and the adjacent rock using moderate pressure.

A large cave in the south abutment of the dam near the river level is being filled with concrete to prevent further erosion and possible weakening of the abutment.

A spiral stairway 186 feet high is being placed on the vertical downstream face of the dam connecting the crest and the roof of the powerhouse. It will be used to reach the powerhouse when the spillways are discharging.

A new suspension footbridge from the service road on the south side of the river a quarter mile below the dam will connect with a trail on the north side which leads up to the dam and thence to the gate house of the auxiliary spillway tunnel.

Conclusion

After enumerating some of the difficult and trying features of the job, it is only fair to mention one or two favorable circumstances.

The location of suitable sand and gravel deposits within one-half mile of the work plant was of great assistance in providing the aggregates for concrete.

While spring floods often threatened, they never materialized, and the untold damage and delay that would have resulted appears now only as a bad dream.

The remainder of the job seems to promise as many interesting and unique situations as have already been encountered. Of course, the spectacle of the spillways discharging at the same time as the tunnel is an event that can only be conjectured. However, water leaping from the spillways and dropping 200 feet into the river, or water emerging from the tunnel outlet at express-train speed are sights which may be anticipated in the near future.

Notes for Contractors

Specification no.	Project	Bids opened	Work or material	Low bidder: Name	Low bidder: Address	Bid	Terms	Contract awarded
887-D	Central Valley, Calif.	Mar. 15	Street, alley, parking area, and sidewalk grading and surfacing, and water and sewer systems, Government camp at Friant Dam.	Andrew J. Clausen	Berkeley, Calif.	$24,966.98		Apr. 29
B-33500-A	Yakima-Roza, Wash.	Apr. 5	Steel reinforcement bars, 3,186,258 pounds.	Carnegie-Illinois Steel Corporation.	Duluth, Minn.	92,181.02	F. o. b. Pomona, Wash., discount ½ percent b. p. v.	Do.
905-D	Casper-Alcova, Wyo.	do	69,000 barrels of modified portland cement for Casper Canal and Seminoe Dam.	Monolith Portland Midwest Co.	Denver, Colo.	[1] 134,200.00 [2] 27,750.00	F. o. b. Laramie, Wyo. do	Apr. 26 Do.
900-D	Burnt River, Oreg.	Apr. 1	Two 2-foot 9-inch by 2-foot 9-inch high-pressure gate assemblies and 1 pier nose for outlet works at Unity Dam.	Commercial Iron Works.	Portland, Oreg.	11,840.00	Discount ½ percent	Do.
25571-A	Rio Grande, N. Mex.	Apr. 9	8,000 barrels of standard portland cement in sacks.	Southwestern Portland Cement Co.	El Paso, Tex.	[2] 22,800.00	50-cent discount and sacks.	Do.
38385-A	Columbia Basin, Wash.	Apr. 16	Steel reinforcement bars, 2,942,685 pounds.	Carnegie-Illinois Steel Corporation.	Duluth, Minn.	92,014.10	F. o. b. Odair, Wash., discount ½ percent b. p. v.	May 4
21042-A	Boise-Payette, Idaho.	Apr. 14	35,000 barrels of standard portland cement in cloth sacks.	Oregon Portland Cement Co.	Portland, Oreg.	84,000.00	F. o. b. Lime, Oreg., 50-cent discount and sacks.	Do.
B-23278-A	Boulder Canyon, Ariz.-Nev.	Apr. 9	12,000 barrels of standard portland cement in paper sacks.	Union Portland Cement Co.	Denver, Colo.	16,800.00	F. o. b. Devil's Slide, Utah.	May 6
A-42211-A	All-American Canal, Calif.-Ariz.	Apr. 1	Steel reinforcement bars, 4,279,719 pounds.	Judson Steel Corporation.	Oakland, Calif.	127,816.48	F. o. b. Oakland, discount ½ percent.	Apr. 26
893-D	Yakima Storage, Wash.	Mar. 30	Five 50,000-pound capacity, motor-driven, radial-gate hoists for Cle Elum spillway.	Valley Iron Works	Yakima, Wash.	12,000.00	F. o. b. Yakima, discount 5 percent.	May 10
894-D	Central Valley, Calif.	Mar. 31	Liquid petroleum gas storage and gasifying equipment, pipe and fittings, gas meters, heaters and fuel, Friant camp.	B. Ransome Scott Co.	Emeryville, Calif. San Francisco, Calif.	[3] 7,130.00 [4] 1,524.35	F. o. b. San Francisco. F. o. b. Los Angeles.	Apr. 28 Do.
908-D	Owyhee, Oreg.-Idaho.	Apr. 21	Earthwork, South Canal laterals, Succor Creek division.	Joseph P. Brumbach	Parma, Idaho	9,662.00		May 3
707	Central Valley, Calif.	Mar. 5	Office building, dormitories and residences at Government camp at Friant Dam.	Guy E. Hall do W. J. Ochs	Los Angeles, Calif. do Fresno, Calif.	[3] 8,139.00 [4] 35,882.00 [5] 50,411.00		Apr. 30 Do. Do.
909-D	Yuma, Ariz. Carlsbad, N. Mex.	Apr. 21	2 ditch-cleaning and excavating machines.	Ruth Dredger Manufacturing Corporation.	Los Angeles, Calif.	22,700.00	F. o. b. Los Angeles, discount ½ percent.	
890-D	Burnt River, Oreg.	Apr. 1	Construction of relocated State highway at Unity Reservoir.	George B. Henly Construction Co.	Ontario, Oreg.	28,737.00		May 12
907-D	All-American Canal, Calif.-Ariz.	Apr. 23	Preparation of concrete aggregates.	Triangle Rock & Gravel Co. and Charles Holmes.	San Bernardino, Calif.	108,400.00		May 18
910-D	do	Apr. 26	Trash-rack metalwork for canal headworks.	St. Louis Structural Steel Co.	East St. Louis, Ill.	22,700.00	F. o. b. East St. Louis, discount ½ percent.	Do.
914-D	Shoshone-Heart Mt., Wyo.	May 3	Construction of laboratory and warehouse.	Charles M. Smith	Thermopolis, Wyo.	6,073.00		May 7
33,587-A	Yakima-Roza, Wash.	Mar. 18	85,000 barrels of standard portland cement in bulk.	Pacific Portland Cement Co.	San Francisco, Calif.	[3] 173,429.92	F. o. b. Pomona, Wash.	Apr. 29
43,096-A	Moon Lake, Utah.	Mar. 12	6,000 barrels of standard portland cement in cloth sacks.	Portland Cement Co. of Utah.	Salt Lake City, Utah.	16,080.00	F. o. b. Heber, Utah	Mar. 24
42,230-A	All-American Canal, Calif.-Ariz.	Apr. 19	Steel reinforcement bars, 800,529 pounds.	Truscon Steel Co.	Los Angeles, Calif.	23,222.21	F. o. b. Calexico, Calif.	May 18
25,019-A	Truckee Storage, Nev.-Calif.	May 3	9,000 barrels of standard portland cement in cloth sacks.	Cowell Portland Cement Co.	Cowell, Calif.	23,445.00	F. o. b. Boca, Calif.	Do.

[1] Item 1. [2] Item 2. [3] Schedule 1. [4] Schedule 2. [5] Schedule 3.

District Land Problems

By W. C. Muldrow, Engineer-Manager and Secretary, Sunnyside Irrigation District

THE Sunnyside irrigation district is a small unit of 4,600 acres under the Sunnyside division of the Yakima project, situated near Benton City, Wash., in the lower Yakima Valley. Completed by the United States Bureau of Reclamation in 1914, it was the first Government-constructed unit to be organized under the irrigation district laws of the State of Washington and the first to have its irrigation system turned over to it for operation immediately after construction.

During the past several years the district has remained on a cash basis, with a substantial surplus. It has bought its own bonds 2 years in advance of due dates. It has declined all moratoria extended by acts of Congress and has met all contract payments in full. It hopes always to do so. In this it has been greatly aided by a revision of its repayment contract with the Government in 1932, extending its payments over 30 years instead of 20; and by a refunding bond issue taken by the State of Washington through its reclamation revolving fund at 1 percent interest, replacing a 6 percent issue. For the past 5 years the district assessments have averaged $4.50 per acre annually for all purposes, including bond and contract payments, operation and maintenance, and improvements.

The picture was not so bright, however, in the spring of 1932 when the writer took over the management of the district. Through tax deed for nonpayment of water assessments, the district found itself in possession of about one-third of all its lands. This included submarginal lands—the thin, sandy, and steep lands. It also included some 1,200 acres of developed lands—ranches ranging from fair to first class. But these places, were almost without exception, run down and impoverished until they would not produce enough to carry themselves, i. e., pay for water and taxes. That, of course, is the only reason that owners let lands go to tax deed. Conversely, that is the only kind of land an irrigation district gets. Nearly all these lands had been farmed through 1-year leases, subject to sale. Their run-down condition was the natural result of such a practice. No one would buy them at any reasonable price, nor were cash renters available. But good experienced tenants were available for share-crop leases.

LAND REHABILITATION PLAN

A standard share-crop lease was worked out which gives the district, generally, one-third of farm crops, with special provision for fruit, truck, and perennial crops where the cost of harvesting, packing, etc., is high. It is for 3 years, not subject to sale or any cancelation except for failure to farm in a good and husbandlike manner. This performance clause is made very strong and is rigidly enforced. Tenants are carefully selected and but a few cancelations for poor husbandry have been necessary.

Every effort is made to build these tenants into landowners. As soon as one of them can show a margin which will permit a down payment of 15 to 20 percent on a reasonable price for the place, he is given a share-crop purchase contract. This contract has been carefully worked out along the same lines as the lease, but provides for turning over to the district one-half of all crops or proceeds. The district backs the purchaser, keeps the buildings insured, pays the taxes if he is unable to, and in certain cases it finances seed, necessary repairs, etc. Such items are charged to the account of the purchaser. When the crop returns come in, they are credited first to cover water charges, taxes, and other advances made, if any; then interest on contract balance; then any balance goes to reduce the principal. Administration is not hard boiled. In cases where, by reason of crop failure, low prices, or misfortune the 50 percent crop payment would leave the farm family in hardship or handicap farm operations, a temporary lower rate is authorized.

Results of this program have been encouraging. The 3-year lease, with a policy of renewal if results are good, has enabled these farmers to plan ahead, to build up their soils and to greatly improve production of these places. The district's lands are not a financial problem any more, they are paying, as a whole, more than the normal rates of water and taxes. Some of them several times as much. They have become worth owning. The manager's report to the annual water users meeting as of October 1, 1936, shows 25 leases and 18 purchase contracts. The contract record shows that these people, with three exceptions due to special conditions, had made a living, had paid for water taxes and other advances made, and had reduced their principal from 10 to 80 percent. Considering the level of crop prices through the years 1932–35, this is a distinct achievement. The 1936 season, with much better prices for most crops, will make the picture even brighter when all crops are sold and credited. Many evidences point to even better years ahead. The return of the sugar beet to the Yakima Valley through the development of a blight-proof strain has added a very dependable and profitable crop to the general farm rotation. It promises to grow rapidly into one of the principal crops of the valley.

BAND SHELL IN PARK AT POWELL, WYOMING (SHOSHONE PROJECT). CONSTRUCTED BY THE CITY OF POWELL WITH W. P. A. LABOR

ALL LOCAL INTERESTS PROFIT

Better conditions have greatly stimulated the sale of lands, and seven tracts under lease last year have been sold in the past few weeks. Several more will be sold. The district board takes the sound position that an irrigation district should not be a landlord any longer than necessary, even though it be profitable, but should pass the lands along to private owners as soon as possible. It is also the policy of the district to abandon any land which proves on trial to be submarginal. To have farmers working on places too poor to provide a decent living is no asset to these men nor to the community. Several such units have been abandoned; buildings removed to better tracts; good portions of land added to adjoining units. An effort is made to recombine farm units which have proven uneconomical into units capable of producing a livable farm income. Needless to say, no prospective purchaser is accepted unless he shows himself to be a good farmer and has such capital and equipment as will be necessary to insure a good chance to make a success on the farm.

An effort has been made to keep these people informed as to new crops, improved strains, better practices in culture or pest control, the trend of crop prices, etc., but a scrupulous effort has been made to avoid dictating to these farmers in the details of their work. Anything tending to place them under compulsion has been strictly avoided. The robot type of farmer, who must have somebody else direct his work may be a material success, but he will not make the kind of self-reliant citizen this project or this American Nation needs. It was one of the immortals who said, "Give light and the people will find the way."

Progress of Investigations

(Continued from p. 131)

Rio Grande Basin, Colorado-New Mexico—(*a*) *Conejos River Reservoir and dam sites.*—Surveys of the diversion dam for the Mogote Reservoir, and three additional diamond drill holes on lower Conejos dam site no. 1 were completed.

(*b*) *Wagon Wheel Gap Reservoir.*—A preliminary survey for the relocation of the highway through the reservoir was begun.

(*c*) *San Juan-Chama transmountain diversion.*—A survey of an alternative location for the diversion canal was begun.

(*d*) *State Line Reservoir.*—All field work on this feature was completed at the end of the month. Diamond drill crews drilled one hole near the Ute Mountain site.

Boise (Boise-Weiser-Payette), Idaho—(*a*) *Mountain home land classifications.*—Planetable surveys on this area were continued throughout the month, and mapping was completed on 35,330 acres.

(*b*) *Canal location along Payette River.*—Strip topography was taken along the location line from Banks toward Horseshoe Bend.

(*c*) *Canal location from Boise diversion dam to Dry Creek.*—During the month strip topography in the Dry Creek section was completed.

(*d*) *Garden Valley dam sites.*—A detailed survey was started of the two dam sites at Garden Valley on the South Fork of Payette River.

(*e*) *Twin Springs dam site.*—A detailed survey was started of the dam site at Twin Springs on the Middle Fork of Boise River.

(*f*) *Stream measurements in Weiser drainage.*—Stream gaging stations for the purpose of securing records of stream flow to be used in connection with possible reservoir locations in this area, were established.

(*g*) *Land use surveys—Payette Valley lands.*—A map showing the use of Payette Valley lands below the Black Canyon Dam has been started.

(*h*) *Boise Valley ground water map.*—During the month, available data were assembled, base maps secured, and locations of wells heretofore observed plotted.

Gallatin Valley, Mont.—Data were assembled and given to the designing section for use in the preparation of a preliminary design and estimate for the proposed Spanish Creek Dam on the Gallatin River.

Madison River diversion, Montana-Idaho.—Land classification was continued and the land on the west side of the Madison River near Ennis and Norris is now being classified.

Conchas project, New Mexico.—All field surveys were completed during the month. Alternate studies were made at a number of sites. Canal cross-sections were plotted and earthwork quantities computed. Canal location surveys were plotted and tracings made of the final location. Land classification surveys were completed and areas computed and tabulated.

Deschutes, Oreg.—Review of the reports on the Waldo Lake diversion and the Plainview project was continued during the month, and the review of the draft of the report on the South Unit project was begun.

Grande Ronde investigations.—The feasibility of an aerial topographic survey of the Grande Ronde Valley was discussed and it was further decided that a mosaic could be secured as a base map for the topographic survey. Surveys were started during the month, and consisted of establishing benchmarks and taking topography.

Black Hills, S. Dak.—(*a*) *Angostura project.*—Topographic surveys were continued during the month on the Horse Camp dam-site area. Test pit work was continued and numerous soil auger holes were drilled during the month in search of bedrock.

(*b*) *Rapid Valley project* (previously called the Rapid City project).—Stream and canal discharge measurements were taken. A study was made of the Brennan Reservoir.

Utah.—Some work was continued on (*a*) Blue Bench, (*b*) Currant Creek, (*c*) Dixie project, and (*d*) Gooseberry investigations, and reports are in course of preparation.

(*e*) *Ouray investigations.*—Water supply studies were made to determine the annual amounts of surplus water available from the Duchesne River for the period 1920 to 1936 and the annual demand on storage and a study was also made of the Pelican Lake as a reservoir

(*f*) *Salt Lake City Aqueduct.*—The report on the aqueduct investigations was reviewed and the estimates for capacities of 60 and 130 second-feet on locations A and B were revised.

First Drowning in Elephant Butte Lake

The first drowning in the history of Elephant Butte Reservoir occurred the latter part of April. Two El Paso men, Carlos Frias, 37 years, manager of the Plaza Theater, and Ray Holloway, 31 years, manager of the Ellanay Theater, were the victims. Frias was a part owner of a motor boat which was reported to him as having become loosened from its anchorage and was adrift in the lake. He and Holloway went to the lake to recover the boat. When they were not heard from by the following evening a search was started and Frias' body was found. The water of the lake was very rough owing to high winds and it is assumed that when their motor stalled the boat was capsized. Search for the bodies was hindered by continued wind and rough water.

EMPLOYMENT of labor on the Carlsbad project, New Mexico, was fairly well balanced during April, with only a few unemployed. Work on the farms, W. P. A. projects, and in the potash and oil industries absorbed most of the labor.

Klamath County 4-H Club and F. F. A. Junior Weed-Control Project

By C. A. Henderson, County Agricultural Agent

During the fall of 1936 plans for a Junior Weed-Control Project for 4-H club members and Future Farmers of America members were discussed by the county agent with F. F. A. instructors of several schools and the county club agent. All were agreed that the proposed weed-control project was important and should be undertaken in Klamath County.

The assistance of the Oregon Agricultural College Extension Service was secured in the preparation of plans for this project. The backing of local farm organizations was enlisted, asking that they sponsor this project and make certain awards to the winners. Several local sponsors offered medals to be presented to the winners of the weed-control contest. A commercial company, interested in weed eradication, gave mounts for member's weed specimens and contributed prizes. The interest of all these groups was most helpful to the planning and initiating of the Klamath County Junior Weed-Control Project.

In the spring of 1937 meetings were held at four Klamath County schools. The Junior Weed-Control Project was discussed by the county agent, 4-H and F. F. A. weed eradication contest enrollment cards distributed. These cards were also circulated at other schools and mailed to all boys in 4-H club work in Klamath County. The card provided not only for the signature of the 4-H club or F. F. A. member but also for the consent of the parent reading, "I want my 4-H club boy or girl to participate in the 4-H weed-control contest and will cooperate in helping locate and control the weeds found."

ONE SECTION OF WEED DISTRICT ASSIGNED EACH MEMBER

Each member, following enrollment, is assigned a definite section or part section of land, to be thoroughly examined and all patches of noxious weeds found there to be plotted accurately. Maximum territory allowed each member is one section.

A map prepared by the county pest-control inspector enables the member to plot and chart all weeds in his particular district. Weed patches are plotted by name and size. The location is identified by showing the distance from two distinct landmarks on the property such as corners, fences, ditches, and buildings.

POISONOUS WATER HEMLOCK. SHOULD BE CUT BEFORE SEEDS MATURE.

An attractive mimeographed folder accompanying the map states that the object of the contest is to identify, locate, and eradicate noxious weeds. County weed inspectors will assist local leaders, and accompany contestants on one identification trip, and will assist contestants in weed eradication. Points in the contest are based as follows: Identification of weeds, 10; number of patches found, 20; location in field, 20; location on map, 20; eradication, 20; and diary, 10.

4-H CLUB MEMBERS KEEP RECORD BOOK

Each 4-H club member is required to keep a business-like record of his weed-control work. For this purpose, a 14-page record book was prepared in mimeograph form by the Oregon State Agricultural College Extension Service.

A list of the weeds found in the section mapped by the member will be put down in this record book. For guidance and information, the Oregon Agricultural College furnished each club with Extension Bulletin 412, The Most Important Noxious Weeds of Oregon. This bulletin describes 21 weeds selected from various localities in Oregon, as sufficiently injurious to cause material loss every year in crop production and undue financial outlay in eradication measures.

Another interesting part of the book provides space for telling the methods of identification of the 10 most noxious weeds in Klamath County and the best methods to control them. Mention is made here of new weeds found by the member and sent to the college for identification. Space is also provided for listing the noxious weeds collected and mounted for the club display at the county fair.

Another important item is the land record of the experimental plot where the member will apply and test recommended methods of weed eradication. This land record includes accurate measurements, soil type, method of irrigation, and rental value of the land. This is followed by a report on the methods used to kill the weeds and the percent of kill obtained.

Six pages of the record book are devoted to member's report on Canada thistle, morning glory, Russian knapweed, white top, quack grass, and perennial sow thistle—all weeds unusually troublesome in Klamath County. Members will report on the depth roots usually grow and methods of reproduction, amount of seed produced, ways of spreading, foliage characteristics, and methods of control recommended by agricultural extension bulletins, county agent, and other authorities on weed control.

FIELD TOURS AND PROGRESS REPORTS

During the summer, field tours will be held under the supervision of representatives of the county agent's office or the county pest control inspector. Members will identify noxious weeds found in the county and visit plots where control measures are being applied. Various plots of weeds will receive different treatments, under county supervision, and members will be required to check results throughout the season.

Members will report their progress in weed-control work through cards mailed

at intervals to club leaders. These progress cards, carefully prepared in questionnaire form, request information basically important to any future or present farmer in the eradication of noxious weeds.

WEED-ERADICATION CONTEST AT THE POTATO FESTIVAL

A demonstration contest is planned in connection with the potato festival. At this festival one team of two boys from each club will demonstrate some phase of weed-eradication work as applied to their weed project. The first-place winners in this contest will be awarded an educational trip to the State fair, where they will compete in the demonstration contest there.

Water Hemlock Collects Its Toll

Acting Superintendent Templin, of the Minidoka project, Idaho, writes that water hemlock is evidently still on the job, and encloses in his letter a clipping from the Twin Falls Daily News captioned, "Poisonous Plant Fatal to Youth—'Wild Parsnips' Cause Death of Idahoan; Companion's Condition Critical."

The item, dated April 23, from St. Anthony, Idaho, states that three schoolboys while working on a ditch bank ate "wild parsnip." The school superintendent finding the boys ill determined that the supposed "parsnips" were in reality hemlock roots. Emergency treatment was given and one boy recovered. One boy was in a critical condition at the date of the clipping, and one boy died from the poisoning.

Poisonous water hemlock is erroneously known as "wild parsnip" in many parts of the West. Wild parsnip grows in dry soil. Water hemlock is found in wet places along streams, lakes, and irrigation ditches. The easiest way to distinguish between "wild parsnip" and water hemlock is by the rootstock. The water hemlock grows from a rootstock to which are attached roots that are thick and tubelike. When broken open, this rootstock oozes an oily yellowish sap which is the poisonous part of the weed. The rootstock, cut lengthwise, shows fairly distinct transverse chambers. A picture of the rootstock of the water hemlock can be found on page 76 of the March 1936 Reclamation Era.

Water hemlock is the most deadly of poisonous plants. Because it is a hazard to human life and to livestock in one foreign country where this weed grows, its destruction is required by law.

Extermination of this poisonous weed will be an important part of weed-control work on Bureau of Reclamation projects during the coming season. Full explanation of the way to rid irrigation ditch banks of water hemlock is given in the article on page 142, C. C. C. Demonstrates Improved Practices in Weed Control.

A Silent Foe Invades Our Country

A real service to the farmers of Fremont County has come in the weed control campaign set up by the county commissioners to meet the requirements of legislation provided at Cheyenne.

You may not know it but the facts are that Fremont County agriculture, the basic industry of this part of Wyoming, was about to be wiped out by the infestation of weeds which takes everything before it by choking out all food-producing plants and covering the land with plants which no livestock will eat. This may be regarded as an extravagant statement, but it is true on no less authority than the Extension Service of the State university which started a campaign in this county 5 years ago.

Some of the farmers of the valley became very much concerned when they saw the gradual spread of the weeds on their land. These weeds multiply very rapidly both by seed and root spread. They may enter a place through irrigation ditches and laterals and thus get a start from the banks of the ditches or spread over the land by irrigation water. Once a farm gets a good dose of the seeds it is gone unless something is done about it right away.

This is a problem of which few are aware. It should be well publicized. Everyone should become weed conscious. It should be taught in the schools. It is a serious matter to every merchant in town. It will strangle and choke the greatest resource we have in the county. It will rob homes of their rightful bread and butter.

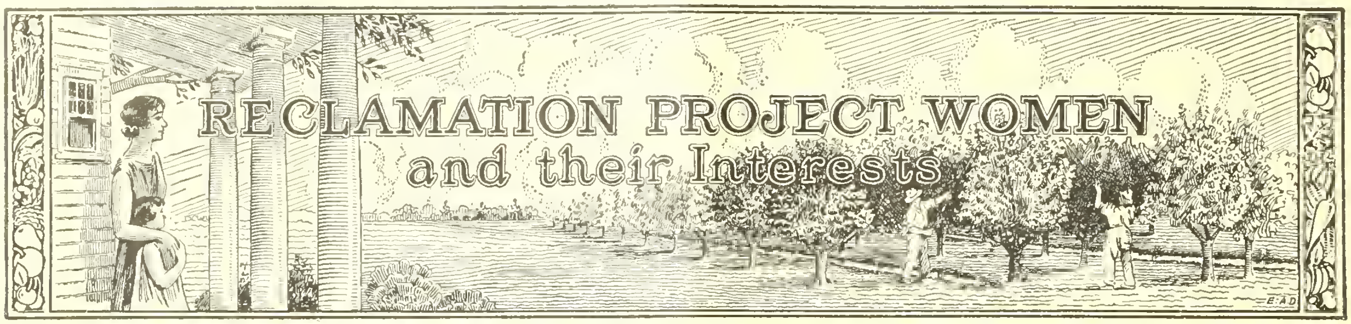
Thus we should all cooperate to the fullest extent in the war on weeds. This invasion must be downed. Upon its success depends the future welfare of our county and people.—*The Lander Journal.*

WORK on the construction of the county courthouse at Las Cruces, N. Mex. (Rio Grande project), is well under way, and a committee of members of all city organizations has been appointed to secure a county hospital in the same city.

SEVERAL sales of farm property have been made recently on the Willow Creek unit of the Vale project, Oregon, and several new settlers have moved on to their farms. Approximately 1,500 acres remain unsold, and one available public land farm unit is still unentered.

THE Naches Heights Community Club, Yakima project, on April 7 celebrated the twenty-fifth anniversary of the founding of the club. Special honor was given surviving charter members. Formed when development of the Tieton division was beginning, the club has been active in the development and enrichment of the social life of the community.

BOISE-PAYETTE DIVISION, BOISE PROJECT, IDAHO. WORKMEN PLACING CONCRETE WALLS OF BENCH FLUME.



The Rio Grande Project, New Mexico-Texas

By Edna Bouldin, Anthony, N. Mex.

THE Rio Grande is the Nile of the Southwest. The many reservoirs and dams along its course pour its waters over thousands of acres of arid lands. It nourishes fields of sugar beets in Colorado and citrus groves in southern Texas. Something like midway between these two lie the cotton fields of the Rio Grande project.

The Rio Grande reclamation project is watered by the stored supply of a reservoir known as Elephant Butte. The name comes from the fact that the big black rock in the middle of the lake may be said to resemble a kneeling elephant. The dam is situated about 120 miles above El Paso. The project begins with the Rincon Valley, 24 miles below the dam. It extends south and east for about 124 miles. Hemmed in by mountains on each side, the valley has an average width of only 6 miles. Compared with the Boulder Dam and the Grand Coulee, both the dam and the project are very small, but they are of considerable importance. The irrigable land in the project, comprising 155,000 acres, is one of the most fertile spots in the world.

INTERESTING COUNTRY

The tourist going to California on Highway 80 gets a good view of the project. Without warning the winding mountain road descends and he finds himself in a very fertile valley. Cottonwood trees line the road bordering fields of cotton and alfalfa. The luxuriant green of the irrigated fields contrasts sharply with the sand hills against the bare brown mountains.

The best time to see the valley is in the summer or early fall. The cotton fields are fruiting then with crops unbelievably heavy. The air is filled with the fragrance of blooming alfalfa. In July the highways are lined with trucks laden with cantaloupe crates to be shipped east to market. Later these same trucks will be full of bales of cotton. The soil of the project seems peculiarly suited to the production of cotton. Fabens, Tex., down near the southern end, claims to be the highest producer per acre in the world. The average production for the project is about a bale to the acre. Some farmers average 2 bales year after year.

The road from Fabens to El Paso is lined with farm homes and villages. Most of the homes are modern houses of brick or adobe. They are surrounded by orchards, vineyards, and beautiful flower gardens. Sweet peas and roses are grown commercially for sale in the city.

If the traveler has time to stop he finds here a country full of historic interest. There are a number of interesting old missions scattered around the valley. The one at Socorro is said to be the oldest in the country. Another one is at Ysleta. The land around this church is said to be the oldest farm in the United States.

El Paso, Tex., is the metropolis of the project. It is a thriving, prosperous city of 120,000 people. It draws much of its trade from the farmers of the surrounding valley. This is demonstrated strikingly by the fact that since the advent of irrigation on the project, the population of the city has doubled. Up to that time the town depended upon mining and cattle. Now to this it adds the trade of a prosperous valley. Business men in the town who are lucky plan to retire and buy a farm in the country.

The highway leaves El Paso and follows the course of the Rio Grande. The road goes through the pass that was known as El Paso del Norte. At the pass the river turns north and ceases to be the international boundary. The road up the valley runs in and out of New Mexico crossing the line permanently at the little town of Anthony. Sierra and Dona Ana Counties, N. Mex., are both included in the project. These parts of the project are also known as the Rincon and Mesilla Valleys. Although the altitude is a little high, cotton in the northern end of the project is still the leading crop, with alfalfa, grain, and melons occupying important places.

Farmers throughout the project are very progressive. They are constantly finding new ways of handling and improving their land and methods of farming. Experimenting with new crops to find those suited to the project is always in progress. Recently some attempt has been made to produce spinach and onion seed for market. Sugar-beet seed is already a well-established crop in the valley.

COOPERATIVE FARMING

There is a strong feeling of cooperation among the farmers. They believe in cooperative marketing. There is a cotton producer's association, an alfalfa association, an egg association, and a pear association. In the past few years a number of farmers have planted pecan orchards and at present pecan growers are getting together.

HYDROELECTRIC POWER

Of immediate interest to the farmers is hydroelectric power. During the past years of drought the water in the dam became so low that the land owners were alarmed. No previous water shortage had actually occurred, but the situation caused anxiety for the future. Much water falls on ranges below Elephant Butte and causes floods or runs off down the river. A new dam was needed to store this water for future supply, and possible use as a source of electric power. The discharge from Elephant Butte is too seasonal to be used for power, but by running the water into another dam this difficulty could be overcome. In the future the farmers hope to sell electric current and thus help to pay off their indebtedness. The new Caballo Dam, now under construction, is located a few miles below Elephant Butte.

Another improvement now under way is the construction of a diversion dam at El Paso. As the Rio Grande is an international river, Mexico had to be given her share of the water. The present treaty calls for 60,000 acre-feet a year to be

diverted at Juarez, but with no means for measuring the water the arrangement has not been satisfactory. The new dam will remedy this situation.

In the 22 years of its existence the project has been of inestimable value to the people of the surrounding country. With the two new dams to add to its efficiency it will become more and more important. In addition to the irrigation feature the project has played an important part in controlling the floods that used to ravage the valley. Contrary to its placid appearance the Rio Grande has done a great deal of damage, and from time to time water pouring into it from the hills in the past has thrown it suddenly out of its shallow banks. Now with the dams to control its flow and with the course of the river straightened it has ceased to become a menace.

All in all the Rio Grande project is one of the world's best places in which a farmer can live. The climate is good and the sun shines almost every day. Winters are warm and pleasant and only a few hours of the day are unpleasantly hot in summer. The one seeming major disadvantage to the country is the fact that some day it will be too small to accommodate the people who will want to live in it.

ELEPHANT BUTTE DAM, RIO GRANDE PROJECT, NEW MEXICO-TEXAS.

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CCC Demonstrates Improved Practices in Weed Control

MANY of the irrigation projects under the direction of the Bureau of Reclamation are fortunate in having located within project limits a C. C. C. camp assigned for the purpose of rehabilitating the irrigation distribution system, the development of additional water supplies and other conservation work of inestimable value to the development of the project.

C. C. C. PROGRAM

At the beginning of the growing season this year a demonstrational weed-control program was started by C. C C. enrollees of these camps as an important conservation activity.

This program is demonstrating the value of the different methods of weed control believed to be most effective and practical, showing how these methods can be used on an irrigation farm. These demonstrational projects include eradication of perennial weeds by root-cutting, grubbing poisonous whorled milkweed and water hemlock, applying oils and chemicals for eradicating weeds along fence lines, highways, and ditch banks, and planting ditch banks with aggressive grasses and clovers to compete with weed growth as a permanent control measure.

Sites selected for this work are in different parts of the project, as conveniently located as possible, in order that farmers may watch the progress of the work and observe the methods used.

Many reclamation projects when first settled were practically free from weeds. The few desert plants native to the land were easy to eradicate by plowing and other farm operations incident to bringing the virgin soil into production. With the coming of irrigation water, weed seeds from upstream, the range, East, South, and even distant foreign countries stole their way in. Ditch banks on many projects became "no man's land" where these newcomers flourished and dropped their seed profusely into the water to infest rich farm fields.

Among the new weeds were many troublesome perennials which spread rapidly, propagating both by roots and seeds. Many irrigation farmers, not knowing how to combat these damaging perennial weeds, found the labor and expense of growing crops increased and crop yields impaired. The first line of attack on noxious weeds—especially perennials with their long-lived, fast spreading root systems—is knowledge of the best practices for eradicating them and the application of these practices.

A WORKING EXHIBIT OF CLEAN ROOT-CUTTING

On many projects there are thousands of acres where crop yields are reduced, and in some instances fields ruined for the growing of profitable crops, by such stubborn perennial weeds as Russian knapweed, wild morning glory, Johnson grass, and horsenettle. To restore this infested land to profitable cultivation, the method used must destroy the root system of the perennial weeds. Where infestations cover large areas, the method believed most practical is clean root-cutting about 5 inches below the ground with a sharp-edged blade.

To demonstrate the value of this method, C. C. C. enrollees are carrying out a root-cutting program on selected plots heavily infested with perennial weeds. For this work, C. C. C. enrollees have built a single-blade weed eradicator similar to the one described in the Reclamation Era of February 1937. The simplicity of construction of this root-cutting tool enables it to be easily assembled by enrollees in camp shops. When discarded road-grader blades are used for the underground cutting blade, the eradicator can be built for a total cost of $15 to $20.

The weed-infested land is plowed and cleaned of surface vines and plants, usually by the farmer cooperating in the program. As soon as the green weed shoots appear, enrollees make the first cutting across the demonstrational plot. From 20 to 30 follow-up cuttings are required each growing season. The demonstration plot is irrigated, if necessary, to maintain favorable growing conditions to expedite the growth of the weeds and germinate any weed seeds. The continued recutting of roots prevents them from manufacturing and storing food, killing the plant by starvation. This takes 1 to 2 years. Soil reclaimed in this manner is planted the first season to row crops requiring cultivation or to a heavy smother crop such as alfalfa. Grain crops should not be planted the first season after completing a clean root-cutting program.

OIL AND CHEMICALS FOR WEED ERADICATION

While root-cutting is believed to be most practical for weed eradication on large areas, small patches of weeds in growing crops and weeds on fence lines, ditch banks and other inaccessible areas, do not lend themselves to this method. For these places, oils or chemicals are usually applied. Oils are top killers, largely useful in preventing weeds from seeding along canals, railroads, and highways. Chemicals are root killers, but the success and effectiveness of the kill depends on soil, moisture conditions, and many other variables. C. C. C. enrollees are demonstrating weed eradication under these methods on several reclamation projects.

CUTTING POISONOUS WEEDS ON DITCH BANKS

Whorled milkweed and water hemlock are two poisonous weeds found on ditch banks on many irrigation projects. Full description of both of these weeds appeared in the March 1936 Reclamation Era.

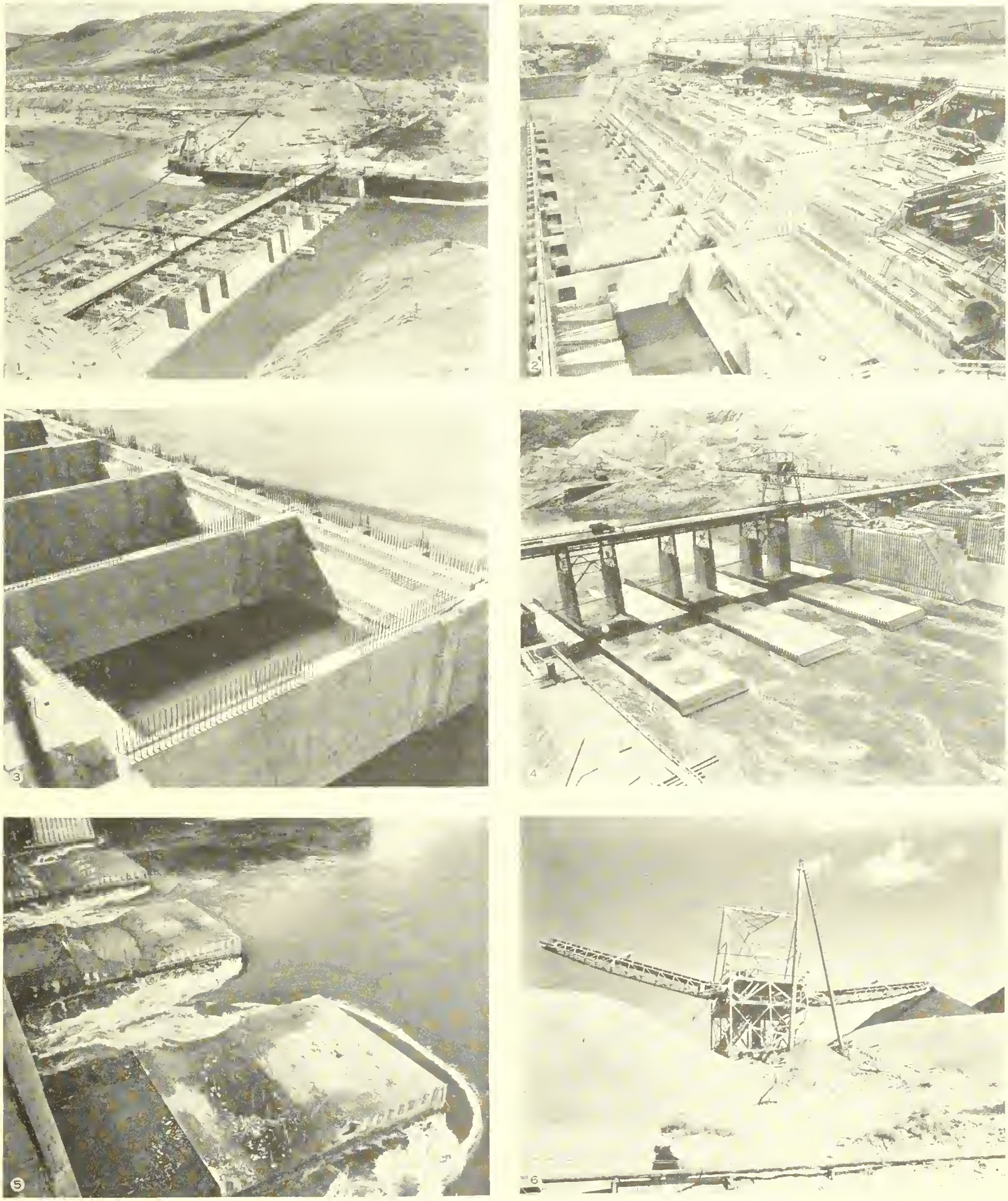
C. C. C. enrollees are demonstrating the methods recommended for eradicating water hemlock. This water-loving weed is killed by cutting it off just below the crown with a sharp blade, doing the work before the seed forms. After cutting, the weeds are collected, placed in wire pens so no stock can reach them and allowed to dry out, being burned as soon thereafter as possible.

On those projects where whorled milkweed is a serious problem, C. C. C.

enrollees are conducting demonstrations showing how grubbing at the pod stage of flower is an effective measure for controlling this poisonous plant.

Irrigation ditch banks on many projects are flourishing nurseries for noxious weeds. While oil and top-cutting are temporary measures useful to prevent seeds from maturing, the process is perpetual. In an effort to find a permanent control measure for weeds on ditch banks,

(Continued on p. 144)



COLUMBIA BASIN PROJECT. WASHINGTON—GRAND COULEE DAM.

1, Looking northeast across damsite, showing Mason City and the gravel plant in the upper left. Diversion slots, through which water will flow in flood stage, are plainly visible. Approximately 58,000 second-feet of water is passing through the four lower slots on the far end; 2, west powerhouse, showing turbine pits and foundation walls completed to elevation 948.87; 3, detail view of turbine pits in the west powerhouse after cleanup work had been completed; 4, diversion channel showing water flowing through at the rate of 65,600 cubic feet per second; 5, detail view at entrance to diversion slots showing the turbulence of water when flowing at a rate of 65,600 c. f. s.; 6, the aeroplane tripper which unloads sand and gravel at the stockpiles

Reclamation Organization Activities and Project Visitors

At the Western States Extension Conference held in Spokane, Wash., May 24–27, W. J. Burke, district counsel at Billings, Mont., represented the Bureau of Reclamation and on the 24th presented a paper by Commissioner John C. Page on the subject, "Range Conservation and Reclamation."

L. N. McClellan, Chief Electrical Engineer in the Denver office, was called to Washington the latter part of May in connection with the consideration of the new electrical contracts on Boulder Dam.

William F. Kubach, chief accountant, Bureau of Reclamation, proceeded to the field from Washington on May 14 to consider with A. R. Golze, supervising engineer, E. C. W., and members of the Denver office staff, the installation of an accounting system on E. C. W. projects similar to that used on the Federal Reclamation projects.

L. H. Mitchell, field supervisor, left the Washington office May 21, for extensive field work during the coming summer on Bureau of Reclamation projects. After spending several days at the Denver office, Mr. Mitchell joined A. R. Golze, supervising engineer of the Emergency Conservation Corps, at Grand Junction on May 27 for an inspection trip of conservation work being carried on by C. C. C. enrollees on the Colorado projects.

Mr. Mitchell will devote the remainder of the summer to important field work on Bureau of Reclamation projects, returning to Washington in the early fall.

A. R. Golze, supervising engineer, Emergency Conservation Work, left Washington the evening of May 19 on a short business trip to Denver and the Reclamation projects in Colorado and Utah. Mr. Golze made a short visit to Bureau of Reclamation C. C. C. camps in Colorado and Utah, but most of his time was spent in the Chief Engineer's office at Denver conferring on matters pertaining to the supervision and operation of the Bureau of Reclamation C. C. C. camps.

Porter J. Preston, senior engineer in charge of the Colorado River investigations, spent several days in the Washington office early in June, in connection with project affairs.

Hon. Henry H. Blood, Governor of Utah, visited the Washington office of the Bureau of Reclamation in an official capacity on June 3.

Two employees of the Bureau of Reclamation, Charles R. Lillybridge and Milo A. Slawson, and Herbert Bowen, a Boulder City resident, were reported drowned sometime during the evening of April 21, while sailboating on Lake Mead.

Amel Doresett, employee of the Bureau of Reclamation at Boulder City, Nev., died of injuries sustained when struck by a "hit and run" driver on Las Vegas Highway on April 11.

The following recent appointments to the Bureau of Reclamation have been approved by the Secretary of the Interior:

Washington office:

Sherwood E. Collins, Jr., engineering aide, Emergency Conservation Work Division.

James H. Steedman, clerk, Operation and Maintenance Division.

Denver office:

Garry H. Austin, junior engineer, vice Jack H. Craven, resigned.

George V. Bessler, junior clerk, from United States Employees' Compensation Commission, Washington, D. C.

Tracey W. Cahow, assistant engineering draftsman.

John B. Goodman, assistant engineer.

Alamogordo Dam, Carlsbad project:

Robert R. Earickson, inspector.

Central Valley project:

Philip P. Dickinson, assistant director of information.

Hansel R. Whaley, junior photographer.

Columbia Basin project:

Wm. H. Irwin, junior geologist.

CCC Work

(Continued from p. 143)

C. C. C. enrollees are making demonstrational plantings of aggressive grasses and clovers on the banks at the head of selected laterals and canals.

Strawberry clover, an unusually aggressive legume which thrives on seeped land and can tolerate a considerable degree of alkali, is planted on moist ditch bank berms and on selected plots of seeped alkali lands. The plot selected for the strawberry clover is cleared of all surface weeds and vines. After carefully preparing the seed bed, C. C. C. enrollees plant the seed at the rate of about 2 pounds per acre, experience indicating that one plant per square foot will spread strawberry fashion to fully cover the ground with vines.

Fences are constructed about the demonstration plots to protect the young plants from livestock and poultry which relish it highly. C. C. C. enrollees also exercise proper care to prevent destruction of the clover by insects and rodents.

As Strawberry Clover, grown for pasture on seeped alkali land, has been observed to choke out such weeds as salt grass and fox tail, the plantings of this clover by C. C. C. enrollees are affording an opportunity to observe if it can be used as a desirable plant on ditch banks to hold the soil firmly and to replace unsightly, damaging weeds.

Enrollees also are planting Brome and other hardy grasses on the upper portions of ditch banks. Brome grass is highly tolerant of dry conditions and forms a thick sod. It makes excellent pasture and may be grazed by sheep and cattle after a good stand is established, provided the irrigation water is not used for culinary purposes. This grass also makes a highly nutritious hay when cut just before flowering.

The strips of canal banks selected for demonstrational use are mostly at the head of canals and laterals, so that seeds from the initial plantings of the grass may drop into the water and seed themselves at other locations along the distribution system. On some projects where there is sufficient moisture from rainfall or seepage, C. C. C. enrollees are smoothing ditch banks before planting to permit the use of machine equipment for clipping any intruding weeds and for harvesting the grass.

C. C. C. WILL WELCOME VISITORS

Farmers are cordially invited to visit the sites where C. C. C. enrollees are carrying on demonstrational weed-control work and observe the progress of this work. The regional director of the Civilian Conservation Corps and his supervising foreman will be glad to explain how the work is being done and what farm operations and tools are required to start a similar program on the farmer's own land.

U. S. GOVERNMENT PRINTING OFFICE 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page,** Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr. of Operation and Maintenance; A. R. Golzé, Supervising Engineer, E. C. W. Division; William F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief, Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz	R. B. Williams	Constr. engr	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Fort Sumner, N. Mex	Wilfred W Baker	Constr. engr		do	Do.
Casper Alcova	Casper, Wyo	H. W. Bashore	do	C. M. Voyen	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex	H. P. Bunger	do	William F. Sha	H. J S DeVries	El Paso, Tex
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Frenchtown, Mont				W. J. Burke	Billings, Mont.
Gila	Yuma, Ariz	R. B. Williams	Constr. engr		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Superintendent	Emil T Ficenec	J R. Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev	L. J. Foster	Constr. engr	George B. Snow	do	Do.
Klamath	Klamath Falls, Oreg	B E. Hayden	Superintendent	W I Tingley	B E Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont	H. H. Johnson	do	E. E Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont	H. V. Hubbell	Constr. engr	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Acting supt	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr	Francis J. Farrell	J. R Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo	C. F. Gleason	Supt of power	A T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr engr	H W Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif	D. L. Carmody	Superintendent	W. D Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg
Parker Dam [3]	Parker Dam, Calif	E. A. Moritz	do	George W. Lyle	R. J. Coffey	Los Angeles, Calif.
Pine River (Vallecito Dam)	Bayfield, Colo	Charles A. Burns	do		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	Superintendent	H. H Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N Mex	S. F. Crecelius	Constr. engr		do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz	E. C. Koppen	Constr. engr	Edgar A. Peek	R J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo	Walter F. Kemp	Constr. engr	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont	A. W. Walker	Superintendent		do	Do.
Truckee River Storage	Reno, Nev	L. J. Foster	Constr. engr	George B. Snow	J R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg	C. L. Tice	Reservoir supt		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo	A A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo	C B. Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage [4]	Ashton, Idaho	H. A. Parker	do	Emmanuel V Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash	J S. Moore	do	Philo M. Wheeler	do	Do.
Roza division	do	Charles E Crownover	Constr. engr	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting. [3] Non-Federal. [4] Island Park and Grassy Lake Dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H Tuller	Project manager	F. J. Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M Watson	Caldwell.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo	C. W. Tharp	do	C. J. McCormich	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont	E E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A	Wellsville Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr	President	Dorothy Eyers	Do
Lower Yellowstone	Board of Control	Sidney, Mont	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook division [1]	Alfalfa Valley irrigation district	Chinook, Mont	A L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo	Bert L. Adams	do	Mary E. Harrach	Torrington.
Northport division	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	do	D. D. Harris	Layton.
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	H J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo	M. P. McLaughlin	Irri superintendent	Geo. W. Atkins	Powell.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Superintendent	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn	Payson, Utah	S. W. Grotegut	Manager	E. G. Breeze	Payson.
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	E. J. Gregory	do	E. J Gregory	Fort Shaw.
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D. Martin	Hermiston.
West division	West Extension irrigation district	Irrigon, Oreg	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W U. A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose.
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash	V. W. Russell	Manager	G. L. Sterling	Ellensburg.

[1] Operated by 5 irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Cloo	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash	F. A. Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo	Mills E. Bunger	Senior engineer.
Gallatin Valley	Bozeman, Mont	R. R. Robertson	Engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Do.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo	Frank C. Merriell	Do
Black Hills	Rapid City, S. Dak	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	Denver, Colo	A N Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do.
Conchas	Tucumcari, N. Mex	J. A. Keimig	Associate Engineer.
Grande Ronde	La Grande, Oreg	C. C. Fisher	Engineer.

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DOWNSTREAM VIEW OF HORSE MESA DAM, SALT RIVER PROJECT, ARIZ.

SHOWING RIGHT SPILLWAY, CENTER; OUTLET PORTAL OF AUXILIARY SPILLWAY TUNNEL, LOWER LEFT; AND A PORTION OF THE POWER HOUSE, LOWER RIGHT. (SEE ARTICLE "INTERESTING CONSTRUCTION AT HORSE MESA DAM", P. 132.)

THE RECLAMATION ERA

ROOSEVELT DAM, SALT RIVER PROJECT, ARIZONA

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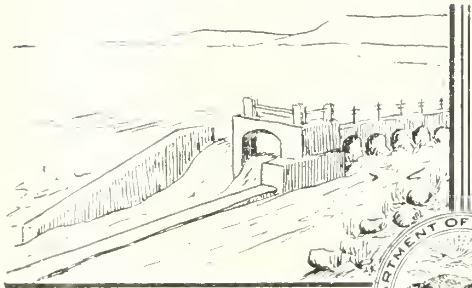
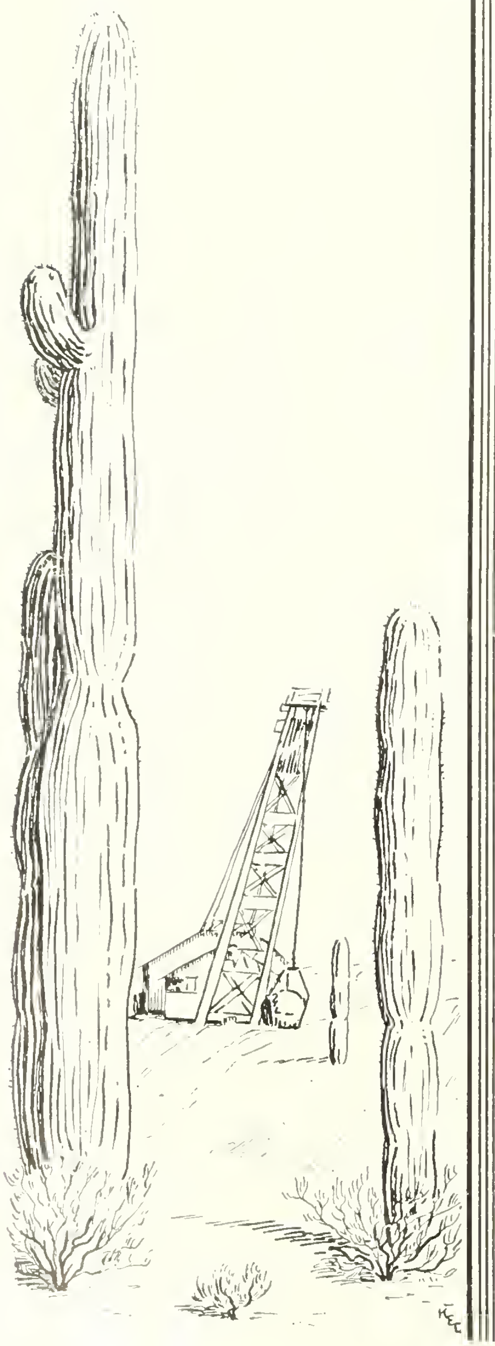
THE RECLAMATION ERA

PRICE: 75 CENTS A YEAR

HAROLD L. ICKES
SECRETARY OF THE INTERIOR

JOHN C. PAGE
COMMISSIONER, BUREAU OF RECLAMATION





CONTENTS

Range Conservation and Reclamation

By John C. Page, Commissioner of Reclamation [1]

THE agriculture of the 11 Western States is largely confined to two distinctive types, irrigation farming and grazing. The amount of forage produced on the public and private pastures and by irrigation, despite the tremendous disparity in the acreages devoted to each, is almost of equal value when measured in feed units. Thus each is of equal importance to the livestock industry.

Although irrigation and grazing are totally dissimilar, in this arid and semiarid region they are closely related and interdependent. Without irrigation the forage and feed necessary to carry through the winter the numerous flocks and herds using the public domain could not be provided economically. Conversely, the gigantic livestock industry in the West is a pillar of support for the irrigation farmer, without which his efforts to make a living and to build up the western communities would surely fail.

Range conservation, therefore, is a matter of primary importance to the irrigation farmer, and reclamation is a matter of vital interest to the livestockmen who use the ranges, while together these two comprise a single program upon the success or failure of which, to a very high degree, rests the future of one-third of our country.

In an area where the materials with which to build a stable and permanent civilization are so drastically limited by nature, no group can without risk to itself close its mind to the problems afflicting other groups.

There has been a tendency for the livestock men to look upon reclamation as principally the concern of the irrigation farmer. Similarly, there has been a tendency for the irrigation farmer to consider the conservation and use of the public ranges as a matter principally affecting the livestock men, and, in addition, the people in the western urban centers all too often have looked upon both with complete indifference.

But, a city built upon the sands has no security. Particularly is this so when it is built upon the sands of the desert, unless the city makes its own security through fostering wise use, protection and careful husbandry of the land and water resources which support it.

Until recently, the development of the West was a haphazard growth. It has only been during the last generation that the necessity for conservation and planning for prudent use of its resources has been realized by our people.

SMALL ACREAGE OF SEMIARID STATES UNDER CULTIVATION

Let us consider briefly the West's situation. These semiarid States have more than 700,000,000 acres, but only 4 percent of this vast area is cultivated in both dry and irrigated farms. Approximately 18,000,000 acres are irrigated. They have, however, 539,800,000 acres, 72 percent of their area, which can be classed as natural pasture, useful for grazing. Of this, 347,000,000 acres are federally owned. In these States, in addition, are about 87,000,000 acres of timber and 100,000,000 acres of wastelands which have no value, however slight, for agriculture.

> ## *Western States Extension Conference*
>
> *The Western States Extension Conference was held in Spokane, Washington, May 24–27. On the program were the following:*
>
> *Harry H. Brown, Assistant Secretary; C. W. Warburton, Director, Extension Service; Hugh H. Bennett, Chief, Soil Conservation Service; George E. Farrell, Director Western Division, Agricultural Adjustment Administration; L. C. Gray, Director of Land Utilization, Resettlement Administration; W. C. Henderson, Associate Chief, Bureau of Biological Survey; Miss Madge J. Reese, Home Demonstration and 4–H Club Field Agent; W. W. McLaughlin, Chief, Division of Irrigation; Walter L. Dutton, Assistant Forester in Charge of Range Management; J. K. Wallace, Specialist in Livestock Marketing; D. C. Mumford, Senior Extension Economist; and W. K. Williams, Extension Forester, all of the United States Department of Agriculture; W. J. Burke, District Counsel, Bureau of Reclamation, Billings, Mont., representing John C. Page, Commissioner of Reclamation; W. A. Lloyd, in charge, Western States Extension Service; Miss Rena B. Maycock, Assistant Director for Home Economics, Utah Extension Service; Mrs. Mary H. Isham, Regional Director, Women's and Professional Projects, Works Progress Administration; and R. B. Tootell, Acting Reviewing Appraiser, Farm Credit Administration.*

Ninety-five percent of the acreage irrigated in the United States lies in the Western States. Likewise, 95 percent of the public pastures is concentrated here.

We have in this western region built an amazing industry through the combined use of our public ranges and our irrigated farms. This industry, the livestock industry, is the largest and most important in these States. Its security must be safeguarded or the whole West will suffer, and its people equally, no matter what their pursuits.

OPERATION OF TAYLOR GRAZING ACT

In 1902, with the passage of the Federal reclamation law, water was recognized in this area as a primary resource and its conservation and prudent use as a national problem. It was much later, however, that the Nation as a whole awakened to the necessity of protecting and conserving the West's second major resource—its public pastures. When President Roosevelt signed the Taylor Grazing Act in 1934, authorizing the regulation of 165,000,000 acres of federally owned pastures, the second major bulwark against misuse and exhaustion of the western resources was erected.

Since this law was enacted, the first real progress toward stabilizing the public land ranges has been made. Forty-nine grazing districts encompassing 110,000,000 acres and each about as big as Connecticut have been organized. Stockmen themselves have a very large part in the administration and policing of these districts. Long strides have been made toward eliminating overgrazing, which only a few brief years ago was a real threat to destruction of the public pastures. In 1936 a 13-percent reduction was made in the number of livestock using the regulated ranges. In 1 year the total number of cattle and sheep on these pastures was trimmed by 1,169,474 head, and this was done largely by the awakened livestockmen themselves.

[1] Paper read in Spokane, Wash., by W. J. Burke, district counsel, at meeting of Western States extension agents, May 24, 1937.

The significance to the irrigation farmer of this new and promising development in our somewhat checkered history of public land administration should be obvious.

In the first place, conservation of the ranges means perpetuation of the livestock industry, and the irrigation farmer must have the livestock industry.

In the second place, it means that the brakes on erosion, which were loosened by overgrazing, will again be applied. Reservoirs, canals, and the very water supply upon which the irrigation farmer relies can be destroyed by the erosion of the soils from the watersheds to be deposited in the channels which serve him.

And third, the shift in cover from the native grasses to such dangerous weeds as the Russian thistle and the mustard plant because of overgrazing not only reduces the value of the ranges, but may also damage irrigation projects in adjacent areas. The sugar-beet industry recently was driven from some sections of Idaho by the white fly. There is much evidence that this occurred because mustard and Russian thistle, which harbor the white fly, had taken large areas of overgrazed ranges in the vicinity of the afflicted areas.

What do the livestockmen say of this relationship between reclamation and the ranges. Mr. Farrington Carpenter, Director of Grazing of the Department of the Interior, says the two are interdependent.

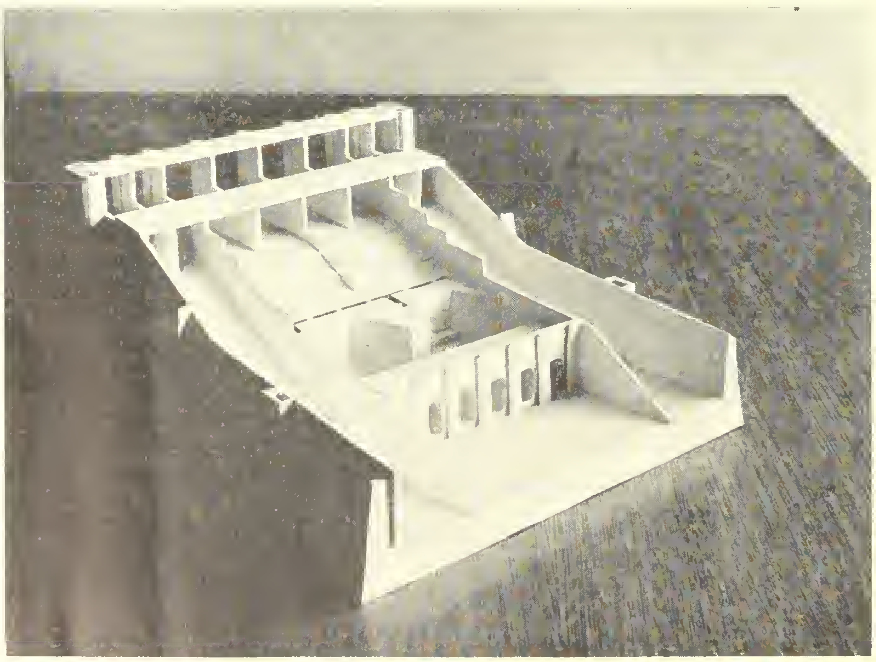
Several months ago. Marvin L. Bishop, secretary of the Natrona (Wyo.) County Woolgrowers' Association, said in anticipation of the Casper-Alcova Federal reclamation project, now being constructed in Natrona County:

"From the beginning of time the march of civilization has altered the old system. I do not believe that many of the wool growers of today would like to go back to the hardships of the old system. Reclamation will make a further change in the raising of sheep. There will be smaller herds, a better breed of sheep shearing more pounds of wool than today. With the assurance of sufficient feed at a reasonable price there will be more early shed lambing resulting in a larger percentage of lambs. The farmers on the project will have a few sheep of their own. Even though less sheep are run in this country the profit per head will be greater than it is today. So with the changing conditions that are inevitable the wool grower will welcome reclamation. He will patiently watch the development of the reclamation project now under way in this country. His dream of protection and his haven of refuse will be in crops growing on this project."

"Between reclamation and the livestock industry", says P. L. Slagsvold, Montana State College agricultural economist, "there is a twofold relationship which is tremendously significant.

"Reclamation projects are the sources of winter feed for the livestock industry. Figures on carlot shipments of hay originating in Montana show a tremendous movement even in years when there is no serious drought. The fact that we have not more irrigated land in Montana prevents us from maintaining our entire livestock industry intact in dry years.

"The irrigated areas are a source of demand for feeder stock from the surrounding country. The development of the Billings livestock market is eloquent evidence of the importance of this."



ALL-AMERICAN CANAL MODEL OF POWER DROP SUPERSTRUCTURE

As an example of the influence of irrigated area upon the livestock industry, the Minidoka project in Idaho might be cited.

This was a typical sage-brush desert before the canals were completed. A small number of range cattle were grazed along the banks of the Snake River, less than 2,000. Now the Minidoka project supports 19,000 head of cattle, of which 4,400 are raised for beef, 1,400 are range feeders and 13,000 are dairy stock. In addition, there are more than 60,000 head of sheep on the project, 14,000 range feeders and 36,000 in farm flocks.

An ideal example of working for a balance between the farms and the range is found in the Sanpete project in Utah, which is the center of the high Sanpete Valley, famous for Rambouillet sheep. Here sheep raising is and must continue to be the major industry. Nearby are about 1,000,000 acres of forest pastures which can be used only in the summer season.

More than 140,000 head of sheep and a smaller but considerable number of cattle graze on the forest lands during the summer. This represents about 60 percent of all the sheep in Sanpete County. The remaining 40 percent are grazed on private ranges and other reserves and on the farm lands.

IMPORTANCE OF LOCAL LIVESTOCK FEEDING

During the winter months many of the large herds are forced to graze on the desert lands along the western border of Utah. Grain, cottonseed meal, and other concentrates are transported long distances to feed them, but despite this, heavy losses are experienced and usually the sheep return to the summer ranges in poor condition. An increase in the production of hay and grain in the Sanpete Valley appears to be the only solution to this situation. To make this increased production possible, the Bureau of Reclamation is providing an additional water supply for the Sanpete farm lands. One unit of this project is now completed, and with the completion of additional units, the benefit to that valley and to the ranges which surround it will be marked indeed.

The fact that the irrigation farmer is able to feed in the locality where they are raised, large numbers of sheep and cattle is a benefit to him and to the livestockman. A ready market and a ready source of supply is mutually beneficial to these two dealers in feeder stock.

The irrigated lands in northern Colorado are one of the world's most extensive feeding areas. There 1,000,000 lambs and 100,000 cattle are fattened annually.

In the North Platte Valley in Wyoming

and Nebraska there are 420,000 acres irrigated, for 80 percent of which the Pathfinder Reservoir of the Bureau of Reclamation provides water. The principal crops are alfalfa, sweetclover, field beans, small grains, corn, potatoes, and sugar beets, and of these alfalfa, small grain, corn, and beet byproducts all are parts of the feeding ration for both sheep and cattle. These are supplemented by cottonseed cake from the South and more corn from the East.

From 1926 to 1936, these irrigation farmers have fed out annually 42,500 head of cattle and 385,000 head of sheep. The livestock is brought in at the close of the grazing season from Wyoming, New Mexico, Colorado, Montana, Nebraska, and a few from other States.

These farmers have added an average of $4,350,000 annually to the value of this livestock between the ranges and the market.

This clearly demonstrates the interest of this particular area in range conservation. The public pastures are the basis of a feeding industry worth $4,350,000 a year in the North Platte Valley. But this is only an example. The same story could be told of virtually all other irrigated areas in the range country.

There is no conflict between the interests of the users of the public pastures and the irrigation farmer. Reclamation and ranges are inextricably tied together by common bonds, mutual interests and the problems before the one affect also the other.

The animosity between the irrigation farmer and the livestockman died with the time when western men did their thinking with their trigger-fingers.

Boulder Dam Starts Repayments

The Colorado River, its neck in the yoke of Boulder Dam, on June 1 settled into the harness for the long pull at its job of repaying, with interest, the cost of the project which tamed it.

No longer the wild-bull river of the West, the Colorado is in harness as a useful and powerful force to serve citizens over a vast area and do its master's bidding. The effect of the regulated Colorado River on the Southwest will be tremendous, since reliable water supplies now are provided for deserts and firm power for industrial centers.

Boulder is the greatest power source in the world and Lake Mead behind the dam is the greatest man-made body of water in the world. The lake is now more than 100 miles long and still growing.

On June 1 the Boulder Dam power plant began production of firm power, and henceforth its gigantic generators will never be idle. Under contracts now in force for the sale of this power, the full cost of Boulder Dam, the power house, and appurtenant structures will be repaid to the United States in 50 years with interest at 4 percent. Also a surplus will be built up for use in making further improvements along the Colorado River.

The Boulder Dam power plant, under the supervision of Director Ralph Lowry, who also is the Bureau of Reclamation's construction engineer, has been in operation since September 1936, but not until now has the Government been in a position to guarantee continuous firm power and levy the full rate of 1.63 mills per kilowatt-hour for this power. Until June 1, the cities of Los Angeles, Burbank, Glendale, and Pasadena, Calif., the power-purchase contractors who now are buying, had been paying half a mill per kilowatt-hour, the secondary power rate.

The whole train of Boulder Dam power-purchase contracts was set in motion by Secretary of Interior Harold L. Ickes, when he notified the southern California municipalities that they would be supplied with firm power continuously after June 1. Other power purchasers are required to begin buying power at stipulated intervals beginning June 1, until at the end of 3 years, the entire repayment schedule will be in effect.

At present there are four generators of 82,500 kilovolt-ampere capacity in operation, producing between 80,000,000 and 100,000,000 kilowatt-hours a month. Four additional units of this size are either in manufacture or on order. Ultimately the power-house will contain 15 of these giant generators and 2 smaller generators of 40,000 kilovolt-ampere capacity. The generators in the power-house at Boulder Dam are the largest in the world.

When installation is complete, the Boulder Dam power-house will have a capacity of 1,835,000 horsepower, by far the largest in the world. The installation at Niagara on the United States side is 452,500 horsepower, the ultimate installation at Wilson Dam (T. V. A.) will be 600,000 and at Bonneville 600,000 horsepower, and the installation at the famous Dnieprostroy plant (U. S. S. R.) is 750,000 horsepower.

The investment of the Government in the Boulder Dam and power plant to date approximates $114,000,000. The first income from the initial installation this year will be about $1,500,000, which will increase under existent contracts.

Illumination of Boulder Dam

The floodlights to light the downstream face of Boulder Dam were turned on for the first time on May 26, 1937. Placed on the parapet of the central section of the power plant were forty-seven 1,000-watt and thirty-one 1,500-watt lamps. Each valve house was lighted by four 1,500-watt lights placed on the parapet of each of the canyon wall outlet works.

Other outside lighting equipment consisted of six 300-watt lamps in the dome of each intake tower, twelve 300-watt floodlights in the walkway parapet around each tower, sixteen and eighteen 60-watt lamps for Arizona and Nevada intake tower bridges, respectively, eighty-one 200-watt lights on the dam roadway, fourteen 200-watt lights on the road to the Arizona spillway, and nine 200-watt lamps on the spillway bridge. Each wing of the power-house structure is lighted by thirty-three 1,000-watt floodlights placed on the roof parapet of the opposite wing. Take-off structures for units N1 to N4, inclusive, are illuminated by eighteen 500-watt lights.

Power Development on Reclamation Projects

The power output per month on the Federal reclamation projects now amounts to more than 140,000,000 kilowatt-hours, and the list of projects with output for May 1937 is as follows:

Project	*Output (kilowatt-hours)*
Arizona, Salt River	42, 718, 970
Arizona-California-Nevada, Boulder Canyon	78, 760, 000
Arizona-California, Yuma	714, 323
Colorado, Grand Valley	701, 660
Idaho:	
Boise	6, 281, 978
Minidoka	7, 339, 000
Nebraska-Wyoming, North Platte	2, 655, 430
Nevada, Newlands	286, 790
Utah, Strawberry Valley	272, 842
Washington, Yakima	644, 180
Wyoming:	
Riverton	99, 390
Shoshone	748, 600
Total	141, 223, 163

THE CORNERSTONE for the new Federal building at Sunnyside, Wash., was laid with appropriate ceremonies on May 6. The Bureau office for the Sunnyside division has been allotted space in the new building.

The Reclamation Era

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

JULY 1937

Speculation in Land Curbed

On May 27, 1937, Congress passed Senate bill 2172, introduced by Senators Bone and Schwellenbach, entitled "An act to prevent speculation in lands in the Columbia Basin prospectively irrigable by reason of the construction of the Grand Coulee Dam project and to aid actual settlers in securing such lands at the fair appraised value thereof as arid land, and for other purposes" (Public, No. 117, 75th Cong., ch. 269, 1st sess.).

SUBSTANCE OF LEGISLATION

The Grand Coulee Dam and appurtenances are now under construction, but prior to the construction of any irrigation works the irrigable lands, under the terms of the new law, must be appraised under the direction of the Secretary of the Interior to determine the value of such lands without incremented value anticipated by the proposed construction of an irrigation project. Repayment contracts with an irrigation or reclamation district must also be executed prior to the commencement of construction of such works. Water rights may be given to individual landowners for holdings of not more than 40 acres, which area may be reduced to not less than 10 acres where the Secretary of the Interior shall determine that smaller units will be sufficient to support a family. For the purpose of determining excess lands under the provisions of the act, husband and wife are considered separate persons and each may hold not to exceed 40 irrigable acres as nonexcess lands, or husband and wife together may hold 80 irrigable acres of community property.

The effect of this legislation is designed to give a chance to bona-fide settlers to acquire a piece of land that would be sufficient to support a family, and at a price which reflects raw desert land value and not a value based on the prospect of the construction of irrigation works; and to break up large land holdings by limiting water rights to 40 acres in any individual ownership. The balance of the land is to be classed as excess land holdings and after appraisal by a board set up on the project, an appraised valuation will be fixed on the land which represents the value at the time of appraisal, without the prospect of acquiring a water right through the Government's investment in irrigation works.

EXAMPLE

In practice it works like this: A landowner whose lands would be watered from storage at Grand Coulee would retain ownership to 40 acres of land, receive a water right for same, and sell excess land holdings at the price fixed by appraisers. For this he would receive cash and enjoy increment in value on the 40 acres in his ownership.

The excess land holdings would be disposed of, giving a new settler an opportunity to acquire land at a price he can afford to pay. This land, at the expense of the settler, has to be cleared of sagebrush, leveled, and in other ways made ready to receive irrigation water. The settler must bear his proportionate share of the cost of the irrigation works. His land must be included within an irrigation district organized under State law providing for payment by the district of that part of the cost of construction of the project, allocated by the Secretary of the Interior, as the part thereof properly chargeable to irrigation. The cost is to be repaid within such term of years as the Secretary shall find necessary but not to exceed the repayment term permitted under the Federal reclamation laws, which is at present 40 years.

ASSISTANCE TO SETTLERS

After construction of the irrigation works the Government's interest lies in the settler and the return of the investment. Everything possible is done to improve conditions of the settlers in an advisory and practical capacity. A contented, happy, and prosperous irrigation farmer on a Federal reclamation project is considered a highly desirable asset.

Since the passage of the original Reclamation Act 35 years ago, many examples of prosperous farming communities have been created by the operations under this policy. By continued vigilance in the matter of protective legislation as it suggests itself for the benefit of the Government and of water users on Federal reclamation projects, we may continue to point with pride to these projects located in nearly every State west of the one hundredth meridian.

LAST LARGE PROJECT

The Columbia Basin project, with the water of the Columbia River stored behind Grand Coulee Dam, has the largest compact body of agricultural land remaining in the United States which may be considered as an irrigation project. Its 1,200,000 acres of land are fertile and need only a regulated and dependable water supply for settlers to make of this section a flourishing farm community, growing crops not necessarily in competition with sections farther east.—*M. A. Schnurr.*

Boulder Dam Tourist Accommodations

EXCELLENT facilities for tourist accommodations in the Boulder Dam area are available. The Boulder Dam Hotel which is first class in all respects, has 86 guest rooms. The room rates are:

For one person, $3 to $5.

For two persons (double bed), $4 to $6.

For two persons (twin beds), $4.50 to $7.

The hotel dining room serves breakfast a la carte; lunch at 75 cents or a la carte; dinner 85 cents to $1.50.

There are two "auto courts", one having 40 cabins, the other 12; cabins with bath at the following rates:

Modern cabins with shower bath from $1 to $2.

Air-cooled cabins for two persons, $3 per cabin.

The Government has just established a tourist camp to be used by persons in automobiles who wish to camp out, either in trailers or on cots in the open air. This camp will be ready for tourists by the middle of June. Probably the charge will be 50 cents per day for each car; the camp has showers and toilets.

It is expected that an additional auto court of at least 40 cabins will be constructed before the end of the current year.

The Hotel Company also is planning to construct this year on the grounds adjacent to the hotel a considerable number of cottages to accommodate tourists at varying rates.

A lodging house, recently renovated, has accommodation for a limited number of tourists at $1.25 each.

Boulder City has four restaurants, two of them air-cooled. Meals are served a la carte at prices from 50 cents to $1.

If traveling by automobile, tourists on either U S 66—the transcontinental highway which parallels the Santa Fe Railroad, or U S 91—the transcontinental highway which parallels the Union Pacific Railroad from Salt Lake City to Los Angeles, would leave Highway No. 66 at Kingman, Ariz., or U S 91 at Las Vegas, Nev., for Boulder City and Boulder Dam. The distance from Kingman to Boulder Dam is approximately 85 miles, and the distance from Las Vegas to the dam is approximately 30 miles. The Union Pacific Railroad operates a bus line from Las Vegas to Boulder City and the dam in close connection with the trains and an independently owned bus line operates between Kingman and the dam and Boulder City, making one trip each way each day of the week.

Traveling by train the tourist leaves the Santa Fe Railroad at Kingman and leaves the Union Pacific Railroad at Las Vegas—for the bus lines above mentioned.

Las Vegas, which is 23 miles from Boulder City, has excellent hotel and auto-camp facilities for tourists in large numbers. Las Vegas has a population of about 10,000. Boulder City's population is about 2,000.

The recreational facilities at Boulder City comprise roads and trails to many points of scenic interest. Lake Mead, the reservoir created by Boulder Dam, is 7 miles from Boulder City. The lake is now more than 100 miles long, and boats traversing the entire length offer pleasure trips of exceptional interest to tourists. The lake is under the supervision of the National Park Service.

DURING the month of May 65,932 persons, traveling in 23,238 cars, were checked through the two checking stations operated by the National Park Service in the Boulder Dam recreational area. Persons making the trip to the powerhouse numbered 28,380, of which number 24,497 were paid admissions, 2,936 were children under 16 years of age, and 947 persons, mostly employees, were not charged. On May 30, 11,154 persons passed through the checking gates, and 4,709 persons made the trip to the powerhouse via the elevators.

SPONSORED by the Boosters' Club, the Glenn County (Orland project) Fair, which was discontinued during the depression years, will once more open its gates to the public this fall. This activity will replace the orange fiesta and turkey show held for the past few years in December of each year.

Service to travelers at Grand Coulee Dam

Hotel facilities in the vicinity of Grand Coulee Dam are rather limited. The Mason City Hotel (in contractor's camp) is clean and quiet with prices ranging from $2 without bath and $3 with bath, single, and $1 additional when double. There is a coffee shop directly across the street. The contractor's mess hall is about 6 blocks distant.

Another hotel is the Continental in Grand Coulee, located on the main highway, 2 miles from the dam. The rates vary from $1.50 to $2, single without bath, $2.50 to $3, double; with bath, $3.50 single and $4.50 double.

There are other and smaller hotels in Grand Coulee. Hotel accommodations are also available at Almira (22 miles), Wilbur (27 miles), and Coulee City (30 miles from the dam).

Modern, well equipped tourist camps are available at Spokane and Wenatchee—each about 90 miles distant from the dam. There are also about eight small towns located on the main highways within a radius of 75 miles from the dam where less elaborate tourist cabins are available.

There are no trailer camps established in this territory, but one that will be located at Grand Coulee is being promoted.

Tourists traveling by train from eastern points disembark at Spokane, arriving there morning and evening, and reach the dam via Washington Motor Coach stages that leave Spokane at 9 a. m., 12:15 p. m., 5 p. m., and 11:59 p. m. These stages arrive at Mason City at 12:25 p. m., 3 p. m., 9:20 p. m., and 4:30 a. m., respectively. The stage leaving Spokane at 12:15 p. m. (daily) is a "special" for the accommodation of visitors to the dam and returns to Spokane at 5 p. m., arriving there at 7:45 p. m. Passengers on this run are given the opportunity to see the job from both of the vista points and listen to short lectures by Bureau guides.

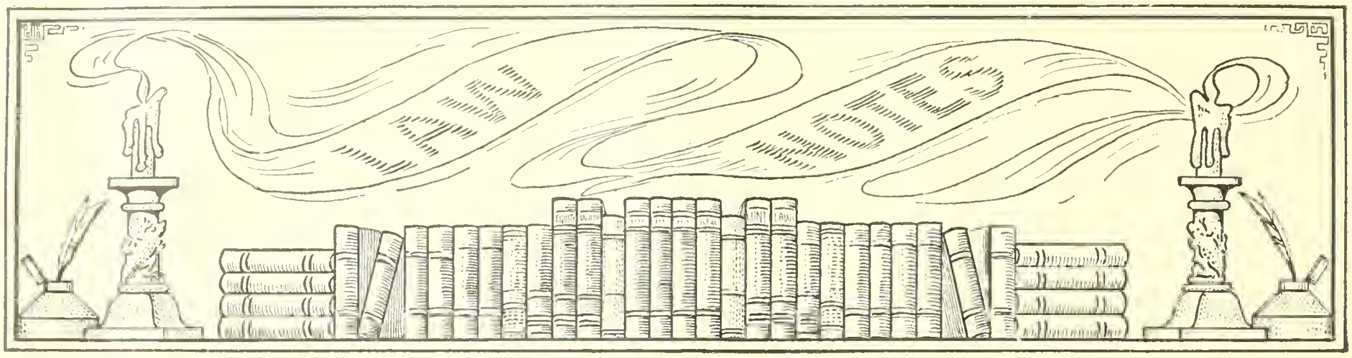
Tourists en route west by train can terminate their train travel at Spokane and continue by motor coach stages via the dam to points on the west coast.

In travel from eastern points, the route to the dam is via Spokane. The distance from the Davenport Hotel (Spokane) to the United States Bureau of Reclamation office is 92 miles via Highway No. 10, diverting to Grand Coulee Dam at Wilbur.

Eastbound traffic can reach the dam by traveling over Washington Motor Coach routes which connect with other stage lines and with railroads and steamship lines at Seattle. If traveling by train from Seattle to the dam, the journey is best made by taking the Great Northern Railway to Wenatchee, and transferring there to a stage for the remaining trip to Mason City; then, to continue the journey east, travel by stage to Spokane, where the rail journey can be resumed.

Meals can be had in Mason City at the mess hall, 60 cents for breakfast, noonday dinner, or supper, or a la carte at the restaurant at reasonable prices; and meals at the several restaurants in the surrounding temporary towns.

There are no recreational facilities nearby, except walks on trails up the rocky sides of the river canyon. Spokane and Wenatchee afford opportunities for fishing in the rivers and lakes in the vicinities.



Controlling Harmful Land Speculation on Reclamation Projects

(Continued from June Issue)

THE Owyhee district does not own the project until it is paid for, and while the district may act as fiscal agent for the United States and attend to the operation of the project before the United States is paid, yet until the United States is fully paid it is a vital and necessary party to any litigation which involves the Reclamation Act and the contract or contracts made with the district and the claimed powers of the Secretary of the Interior involving the Owyhee project. The petition does not state that the United States has been paid or reimbursed.

Until the United States is reimbursed for its advances for the construction of the project, etc., it is so vitally interested in the project and the contracts pleaded in the petition it would be useless to have a State circuit court attempt to adjudicate, in any manner on the petition.

ARIZONA *v.* CALIFORNIA (298 U. S. 558; 80 L. ED. 1331)

Were this lower court to attempt an adjudication against the defendant Owyhee district whereby this district be compelled to deviate from its contracts with the United States it would be folly, for the district would not be relieved from its obligations under the contract or contracts and there would be no finality which would benefit anyone. Any such attempt would stand as an affront to the United States, which is most vitally concerned in the contract or contracts and, really, the necessary party in any litigation objecting to the form or substance of the agreements.

The object of the proceedings is to obtain a declaratory judgment at the instance, in suit No. 4829 E of Henry Terra, the grantee of May M. Pinney and William J. Pinney. The deed that the Pinneys gave to Terra recited "Subject, however, to all the terms and conditions of that certain contract heretofore made and entered into between the United States and the Owyhee irrigation district, in which this land is located." The consideration recited in the deed is $10, but the petition alleges that the real consideration paid by Terra was $3,500, and the appraised value of said land was $2,380. That 50 percentum of the difference between the sale and appraised value is $560, which amount, under the contract, should have been paid to the district, but that the vendors have failed, neglected, and refused to pay said amount to the district. Petition further alleges that Terra, at his own cost, has offered to pay such sum to the district, but that it refuses to accept the same. In suit No. 4833 E of Albert L. and Lydia C. Pfeiler, the deed given to Albert L. Pfeiler by Martha B. and E. M. Greig recited "It is understood that said land is within the boundaries of the Owyhee irrigation district, and subject to the terms and conditions of certain contracts between the grantors and the district, for the construction of the Owyhee project, and that in case the United States shall call for the advance payments on the construction charges, in accordance with the terms of said contracts, that grantee will make such payments as a part of the consideration for this conveyance." The consideration recorded in this latter deed is $10, but the petition alleges that the true consideration was $3,500, and the appraised value of the land $2,576; and that 50 per centum of the difference between the sale and appraised value is $462, which amount, under the contract, should have been paid to the district, but that the vendors have failed, neglected, and refused to pay said amount to the district. The defendant Albert L. Pfeiler and the defendant Lydia C. Pfeiler entered into a conveyance whereby they claim to be joint owners of the lands conveyed by the defendants Greig. Petition further alleges that the Pfeilers, at their own cost, have offered to pay the said sum of $462 to the district, but that it refuses to accept the same. Both petitions allege that at the time of sale the full consideration was paid to the Pinneys and Greigs, respectively, and that there is no money payable to the vendors, respectively, out of which the respective vendees may make payment to the district, and that the district refuses to supply water to the respective tracts of land.

The land conveyed by the Pinneys was obtained by them from Edgar H. and Mary B. Test, by a deed which recited a consideration of $10, and after the description of the land carried the following clause, "Subject, however, to all of the terms and conditions of that certain contract heretofore made and entered into between the United States and the Owyhee irrigation district, in which this land is located"; and covenanted the conveyed premises to be free from all encumbrances "except as to the contract between the United States and the Owyhee irrigation district, above referred to." (See exhibit B to suit No. 4829 E.) The deed from the Pinneys to Terra is exhibit B to suit No. 4829 E. The deeds in the suit No. 4833 E are shown as exhibits B, C, and C–1.

According to law, both of the sets of plaintiffs had notice of the Owyhee contracts. They are not receiving water for their lands, but as a matter of law they knew that water would be refused them when they took the conveyances if the provisions of the contracts were not performed. As far as equity is concerned its reaction to the facts shown does not incline to relieve the plaintiffs from the plight they are in, or the noncorporation defendants from an agreement voluntarily entered into, but which they seek to be freed from. But, even if this court retained jurisdiction as between the noncorporation defendants and the plaintiffs, it could only be for the purpose of assuming the contracts to be perfectly valid and recommending a judgment against such defendants. However, even this would not solve the plaintiffs problems, for a mere judgment might not satisfy the requirements of the Secretary of the Interior—representing the United

States. This weakness is the same were a judgment to be suggested as part of a decree. There could be no finality, and in the face of the contracts, and the paramount interest of the United States these suits are not conditioned for litigation save when the entire problem raised by the law and the contracts are properly before a court. It would be futile to pass upon the point raised in the brief of the Pinneys—their demurrer rather—of the statute of limitations, as from the broad viewpoint the proceeding is against the United States. All defendants have demurred, and therefore no requests whatsoever are before this court on the part of the defendants or any of them; but this is of no moment.

The proceedings are for declaratory judgment. In such proceedings it is said that they are governed by the applicable established rules of pleading.

87 A. L. R. PAGE 1246

It is said by Professor Sunderland (who introduced the idea of the declaratory judgment to this country—see Clark on Code Pleading, p. 231) that, "The advantage of asking advice instead of coercive relief is important. In the first place it presents in the pleadings a specific and express issue of law, which can usually be answered yes or no and which will settle the controversy between the parties. In this way the scope of the legal inquiry presented by the pleadings is clarified and limited. Furthermore, the issue of law is not one which must, as in case of a demurrer, be developed without any accompanying issue of fact. It is usually an issue of law to be decided upon the outcome of the trial or hearing, so that almost every case is capable of being presented as a case for advice. The question to be decided is always the correctness of the declaration asked, and the court has only to answer the specific questions put to it" (16 Michigan Law Review, p. 73; article, 'The Declaratory Judgment; author, Edson R. Sunderland).

The Oregon Declaratory Judgment Act is found in chapter 14, title 2, Oregon Code, as amended, as to sections 2–1402 and 2–1411, by Laws of 1933, chapter 14 (see also 9 Uniform Laws Annotated, 1935 Cum. Ann. Pocket Part, p. 32). When an issue of fact is to be determined it may be done (see. 2–1409 Oregon Code).

Section 2–1402, Oregon Code, is: "Any person interested under a deed. will, written contract, or other writings constituting a contract, or whose rights, status, or other legal relations are affected by a constitution or validity arising under any such instrument, constitution, statute, municipal charter, ordinance, contract, or franchise and obtain a declaration of rights, status, or other legal relation thereunder."

Section 2–1411, Oregon Code, is: "When declaratory relief is sought, all persons shall be made parties who have or claim any interest which would be affected by the declaration, and no declaration shall prejudice the rights of persons not parties to the proceeding. * * * and if the constitution, statute, charter, ordinance, or franchise is alleged to be unconstitutional, the attorney general of the State shall also be served with a copy of the proceeding and be entitled to be heard."

Section 2–1405, Oregon Code is: "The enumeration in sections 2–1402—2–1404 does not limit or restrict the exercise of the general powers conferred in section 1 (S. 2–1401), in any proceedings where declaratory relief is sought, in which a judgment or decree will terminate the controversy or remove an uncertainty."

Section 2–1406, Oregon Code, is: "The court may refuse to render or enter a declaratory judgment or decree where such judgment or decree, if rendered or entered, would not terminate the uncertainty or controversy giving rise to the proceedings."

Section 2–1413, Oregon Code, is: "The word 'person', whenever used in this act, shall be construed to mean any person, partnership, joint stock company, unincorporated association or society, or municipal or other corporation of any character whatsoever."

It will not be necessary to comment to any extent on the above provisions, but under section 11 of the Uniform Act—which is 2–1411, Oregon Code, as amended—the following cases are cited to the effect that all parties having a substantial interest in the matter to be determined must be before the court:

Continental Mutual Insurance Co. v. *Cochran* (Colo.) 4 Pac. 2308.

Huester v. *Lackawanna Co.* (Pa.) 161 Atl. 537.

In re Straus (Pa.), 161 Atl. 547.

State v. *Milwaukee* (Wis.), 246 N. W. 447.

Hall v. *United States National Bank* (Nebr.), 258 N. W. 403.

Updike Investment Co. v. *Employers Liability Assurance Corporation, Ltd.* (Nebr.), 258 N. W. 470.

Cummins v. *Shipp* (Tenn.) 3 S. W. (2d) 1062.

Karriher's Petition (Pa.), 131 Atl. 265.

Lanner v. *Siegel* (Pa.), 144 Atl. 274.

Denver v. *Denver Land Co.* (Colo.), 274 Pac. 743.

Morton v. *Pac. Cons. Co.* (Ariz.), 283 Pac. 281.

Sadler v. *Mitchell* (Tenn.), 36 S. W. (2d) 891.

As the United States is a vital, and necessary party to any litigation involving the matters raised by the petition, the further thought cannot be dismissed from consideration, albeit unnecessary to a decision in the principal case. Does section 2–1413, Oregon Code, which defines the word "person", contemplate a sovereign? Of course the United States can only be sued in its own courts, if it can be sued; but, in any event, can it be made a party to a declaratory judgment proceeding? (See *Inland Milling Co.* v. *Huston*, 11 Fed. Supp. 813.)

Sooner or later the questions raised by the petitions will have to be determined by a court, but until the United States (acting through the Secretary of the Interior) is impleaded it does not seem that a determination can be had.

It would seem that there is authority to implead the United States under 28 U. S. C. A., section 41, subsection 20; but the writer can have no concern in this.

No good can be obtained in ruling on the demurrers, as any rulings would only confuse, and probably place the litigation in a strange condition of uncertainty and of no help to any of the plaintiffs or defendants. Furthermore, were the demurrer of the irrigation district to be passed on it would in a certain manner, if sustained, be perhaps prejudicial to the plaintiffs.

Under the circumstances, the only fair thing to do is to act under section 2–1406, Oregon Code.

Therefore, the court refuses to enter a judgment or decree for the reason that if such were entered it would not terminate the uncertainty or the controversy. The proceeding, each, is dismissed without prejudice. No costs to any party.

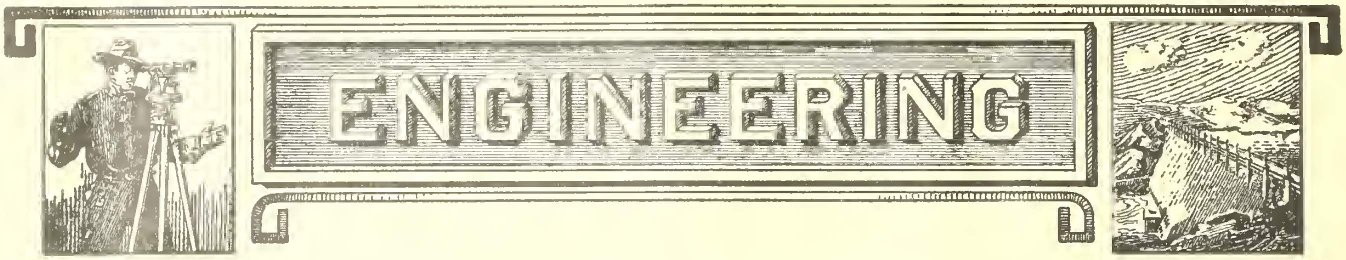
A copy of this opinion shall be filed in each cause.

The attorney for the district may prepare proper orders of dismissal.

THE Star Route for the Willwood division of the Shoshone project, has been extended to include all of the settlers on the division. Mail delivery is now being made three times weekly to the settlers on the east end of the division and daily to others.

THE HAVRE bands (Milk River project, Montana) held their annual festival on May 8. Thirty-nine school bands attended with a total of 1,600 musicians. Stands were located at six chief street intersections where the bands in turn gave concerts. A parade and mass band concert was given in the evening. It is estimated that 15,000 persons attended the concerts.

Milo A. Slawson, guide at Boulder City, Nev., was reported drowned in Lake Mead on the night of April 21.



Construction of Rye Patch Dam

By L. J. Foster, Construction Engineer, Reno, Nevada

THE Humboldt project, of which the Rye Patch Dam is the principal feature, is located in western central Nevada on the Humboldt River stream system. The project was authorized by the National Industrial Recovery Act of June 16, 1933.

Under date of August 24, 1933, the Federal Emergency Administrator of Public Works approved an allotment of $2,000,000 for the construction of the Humboldt project. This allocation of funds became available on September 6, 1933. The President of the United States approved the project on November 6, 1935. On October 1, 1934, a repayment contract was entered into between the United States and the Pershing County Water Conservation district to provide, among other things, for the return by the district of all expenditures made by the United States in the construction of the project.

The bids for the construction of the Rye Patch Dam were received at Lovelock, Nev., on November 12, 1934. The bidding was spirited and there were 21 bids received. The contract was awarded to the low bidder, J. A. Terteling & Sons of Boise, Idaho, and on December 1, 1934, a contract was entered into with said firm for the construction of the Rye Patch Dam under specifications no. 597, contract no. I2r–4562. Notice to proceed with the construction work was issued the contractor on December 27, 1934, and acknowledgement of said notice was made by the contractor under date of December 31, 1934. Actual construction work began on January 17, 1935, and the construction of the dam, except for the parapet and curb walls, was completed by the contractor on June 1, 1936.

The lands of the Pershing County Water Conservation district in the Lovelock area possess decreed natural flow rights from the Humboldt stream system. The purpose of the Humboldt project is to supplement the water supply of the Lovelock area by the construction of a dam to create storage to protect the irrigated lands during low-water years by capturing flood waters during wet years. The 1932–33 investigations of the Bureau of Reclamation disclosed that the Lovelock area not only needed storage but that it was more in need of stream regulation. The stream flow is not subject to advanced predictions based upon snow surveys. The records show that over a 36-year period, the maximum monthly flow occurred as frequently during January to April, inclusive, as it did in May, June, and July, the usual high-water months on other stream systems. The necessity for control and regulation was apparent. The need for complete control of the Humboldt River in the lower reaches necessitates the unification of the upper and lower valleys into one district. The upper valley is partially supplied, at the present time, with late decreed priorities which are amplified by off-stream storage in the Pitt-Taylor Reservoir. A unification program is being considered at the present time and it is hoped that the Lovelock area may realize on its opportunity by adopting such program in the near future.

VIEW FROM EAST SIDE, 1,500 FEET BELOW RYE PATCH DAM, LOOKING UPSTREAM AND SHOWING SPILLWAY GATE STRUCTURE, CONTROL HOUSE, AND DOWNSTREAM FACE. OUTLET WORKS DISCHARGING 465 C. F. S.

CHANGES AND EXTRA WORK

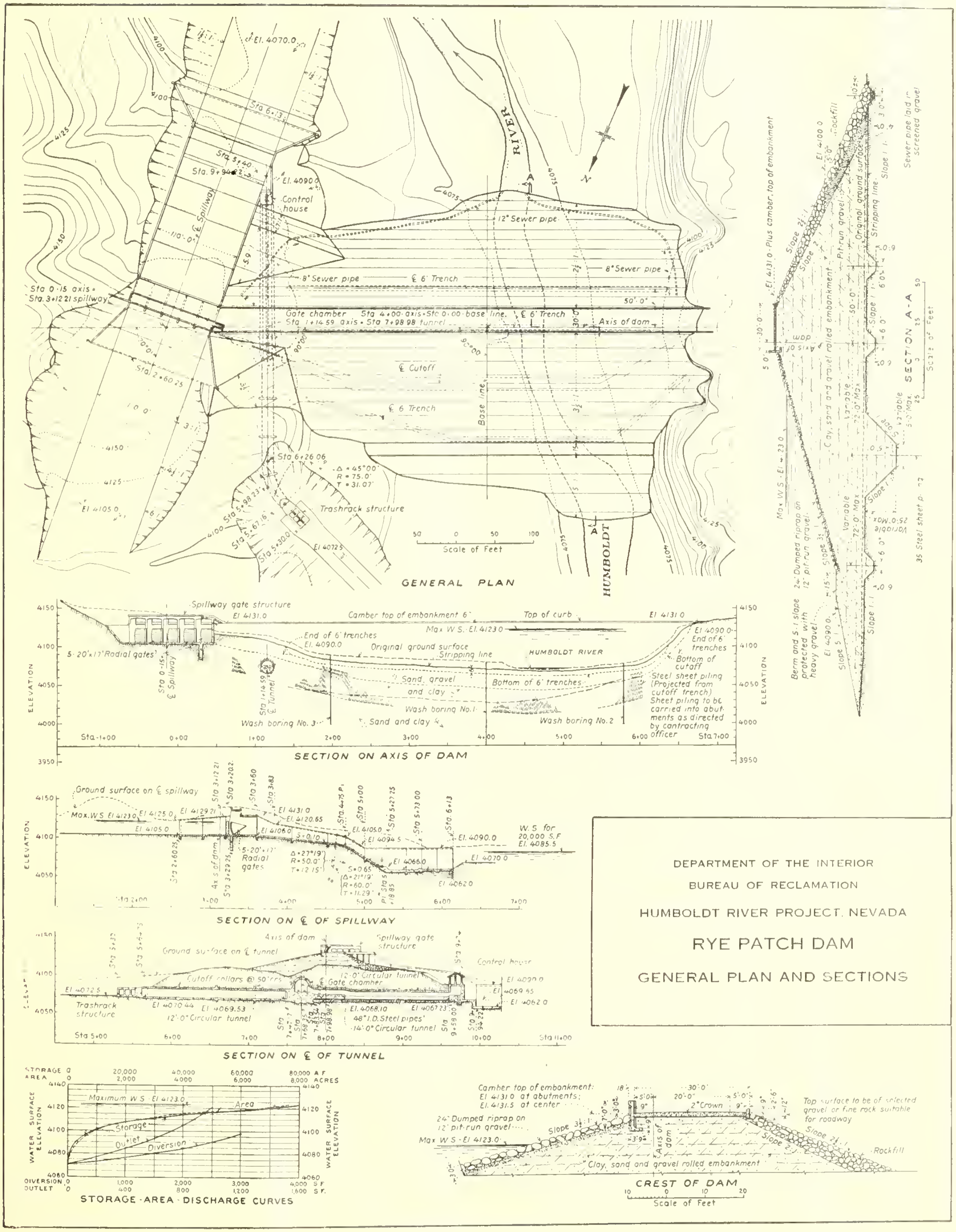
The specifications provided that the contractor "shall complete all of the work within four hundred (400) calendar days from the date of receipt" of the notice to proceed with construction. The United States was delayed in furnishing steel sheet piling to the contractor at the time when he was ready to begin such foundation work. The delay involved a total of 91 days and, in accordance with contractual terms, the performance of the work under the contract was extended to a total of 491 days.

Order for changes no. 1 involved the following principal changes in plan:

(1) The increasing of the height of the embankment by 10 feet to a crest elevation of 4,141.

(2) The raising of the elevation of the spillway gate sills 10 feet to elevation 4,116 and the shifting of the center line of the spillway eastward approximately 35 feet.

(3) The lengthening of the tunnel approximately 70 feet and the moving of the tunnel location eastward approximately 35 feet.



DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
HUMBOLDT RIVER PROJECT, NEVADA
RYE PATCH DAM
GENERAL PLAN AND SECTIONS

RYE PATCH DAM, HUMBOLDT PROJECT, NEVADA. COMPLETED IN THE SPRING OF 1936. OF EARTHFILL CONSTRUCTION. IT IS 75 FEET HIGH. THE RESERVOIR CAPACITY IS 80,000 AC. FT.

Favorable unit prices had been received for the construction of the dam and the increase in height of 10 feet would increase the storage from 80,000 to 179,000 acre-feet. The board of directors of the Pershing County Water Conservation district authorized such change of plan in anticipation that complete unification of the Lovelock area would be had and the additional storage would be needed.

Order for changes no. 2 provided for the omission from the contract of the construction of the parapet and curb walls, but provided that the contractor furnish the aggregates required for such construction, which construction would be accomplished after the dam had attained its full settlement.

Extra work order no. 1 provided for the construction of a test-fill by the contractor. Extra work order no. 2 provided for the cost of driving test piles to determine the size and quantity needed for the completed embankment. Extra work order no. 3 provided for additional rolling by the contractor on account of the character of the materials used in the embankment fill.

DAM AND RESERVOIR

The Rye Patch Dam is located on the Humboldt River 1 mile west of United States Highway No. 40 and 23 miles almost due north of the town of Lovelock, Nev. The main line of the Southern Pacific Railroad is within three-fourths of a mile of the dam site. The capacity of the reservoir will be 80,000 acre-feet without unification and 179,000 acre-feet with unification of the Lovelock area. The dam is of the straight earth-fill type, having a maximum height of 80 feet from the lowest point in the foundation cut-off and a height of 71 feet above the stream bed. The crest is at elevation 4,141 with a crest length of 800 feet. The base thickness is 505 feet. The completed structure contains 302,920 cubic yards of rolled earth embankment, 9,812 cubic yards of pit-run gravel, 8,411 cubic yards of rock riprap on the front face on top of the gravel blanket, and 27,820 cubic yards of dumped rock fill on the downstream face. The upstream face of the dam is constructed on a 5 to 1 slope up to elevation 4,090, at which elevation there is a 15-foot berm and from the berm to the roadway, the front face is on a 3½ to 1 slope, covered with a 12-inch gravel blanket, which in turn is rock riprapped for a thickness of 2 feet in order to afford protection against wave action. The roadway is 30 feet wide. The downstream earthen slope face is built on a 2 to 1 slope. From the foundation to elevation 4,100, there is a pit-run gravel filter 5 feet thick. The downstream face is further covered with a rock fill, having a finished 2½ to 1 slope to provide stability. The downstream toe of the dam is drained through two lines of vitrified pipe, one line extending up the fill on the right abutment and the other line on the left abutment.

The dam embankment is keyed into the foundation by four cut-off trenches, three of which are 6 feet deep with a bottom width of 6 feet and side slopes of 1 to 1. These three cut-off trenches are located 168 feet above the axis of the dam, one at the axis and one 50 feet below the axis. The main cut-off trench is located 80 feet upstream from the axis. On the right abutment, this main cut-off trench runs to the axis of the dam and then along the axis to the end of the fill. On the east abutment the main cut-off trench runs to the spillway at a point about 16 feet above the axis. Through the main part of the foundation and through the left abutment this cut-off trench is 6 feet deep. Through the right abutment the trench reaches a maximum depth of 27 feet in order to cut through a seamy rock ridge.

For imperviousness, a wall of steel sheet interlocking piling is driven through the sand stratum across the river bottom and into the clay stratum below in the main cut-off trench. The piling consists of 16-inch width piling with ⅜-inch web, and is 25 feet long. The piling depth varies depending upon the conditions, the maximum depth driven below the foundation of the main cut-off trench amounted to 23 feet, and the piling protruded into the cut-off trench not less than 5 feet above its bottom.

The earth fill consisted of borrow material of variable densities. Required excavation, if suitable, was used for earth fill. The embankment materials were spread in layers 8 inches thick, and every attempt was made to construct the dam with no low levels or high levels along a horizontal plane. As a rule, the embankment materials did not take water. Sprinkling did not result in satisfactory penetration. As a result, an injector was experimented with and, after development, was used for applying the required amount of moisture. After the required amount of moisture had been injected, the earthen layers were rolled, using tractor and sheep-foot roller. The rollers averaged about 1,800 pounds per linear foot of tread. The number of rollings varied, depending upon the character of the material. A minimum of 6 rollings was provided for in the specifications, but on about 10 percent of the structure it was found that 16 rollings were required to accomplish the desired compaction. On 4 percent of the structure, 20 rollings were required, and the main bulk of the embankment was accomplished with a total of 10 rollings. An earthen laboratory control force maintained uniform conditions in placing, made numerous tests daily on each shift, and experimented with the materials continuously during the construction of the dam in order to secure the required compaction, mechanical analysis, and percolation data.

SPILLWAY

Adjacent to the dam on the east side, and on the left abutment, is the concrete spillway. The spillway is of the overflow type, of reinforced concrete, 353 feet long and 110 feet wide. The spillway section has a discharge capacity of 20,000 c. f. s., and the discharge is controlled by five radial gates 17 feet high by 20 feet wide. The radial gates are operated from hoists located on the operating platform. The

spillway floor is at elevation 4,116 at the gate structure. The spillway discharge leads through a chute into a stilling basin that is approximately 110 feet square. The excavation for the spillway structure was accomplished through material that stood up well, and but little over-breakage occurred. As a result there was only a small amount of backfilling required. The discharge into the stilling basin leads back through an earthen outlet channel to the main Humboldt River. The spillway is heavily reinforced with steel, ranging in size from 1½ to 1¼ inches in diameter. It is estimated that there was an average of 83.2 pounds of reinforcing steel per cubic yard in the spillway structure. Its construction required the placing of 5,316 cubic yards of concrete.

OUTLET WORKS

The outlet works consist of a circular tunnel, 462 feet long and 12 feet in diameter, which extends from the trashrack structure to the gate chamber under the left abutment, the extrance to the gate chamber being approximately 27 feet above the axis of the dam. The tunnel plug is about 37 feet long and thereafter for a distance of 35 feet the tunnel is 15 feet in diameter, after which a transition 10 feet long carriers it back to the original section.

The tunnel roof section was partially protected with liner plates on account of the encountering of a sand and gravel stratum and the tunnel lining (15 inches thick) was heavily reinforced. Semicircular 8-inch channel ribs were used for liner plate supports. The liner plates in the roof of the tunnel consist of variable numbers of 4-inch channels 8 feet long, dependent upon the stratum exposure. While these liners were not required for protection purposes during tunnel construction, they were installed on account of the necessity of preventing cave-ins at the time concrete lining was being placed.

The irrigation flow is controlled by two sets of 3½- by 3½-foot high-pressure cast-iron gates. Each set of gates is connected in tandem with two 48-inch steel pipes which discharge into the spillway stilling basin. The tunnel has a diversion discharge of 3,000 c. f. s. and the outlet works have a discharge capacity of 1,000 c. f. s. at full capacity of the reservoir. The gate frames, bonnets, and conduit linings are imbedded in a concrete plug in the gate chamber. The gate chamber contains the operating mechanism, the hydraulic hoists with oil pipe, the automatic gate hangers for downstream gates and the semiautomatic gate hangers for the upstream gates, and the air valves. The control house is located at the end of the outlet tunnel where the opening and closing of the gates are controlled. In the control house also is located the mercury gage which indicates the water surface elevation of the reservoir.

CONCRETE PLACING

The invert of the tunnel was poured without forms. The upper half of the tunnel was poured with a Pumpcrete. Good results were obtained in placing and there were but few voids. The stilling basin floor and cut-offs and part of the chute floor was also poured with a Pumpcrete. The remaining concrete sections were poured either by use of chutes, by use of wheelbarrow, or by use of hoppers lifted by dragline. All forms were of wood construction and were lined with plyboard.

The aggregates for concrete were obtained from a gravel deposit located approximately 2 miles northeast of the dam site. The sand was obtained from an area approximately one-quarter mile from the dam site. From tests made, it was found that the combination made a rather harsh concrete and the rodability and workability were not up to standard. Consequently, after a number of laboratory experiments had been made, it was decided to add blow sand as a modifier in the proportion of about 10 to 90 percent coarse sand and the results were very much improved. The average F. M.'s during construction ranged from 2.63 to 2.99. The concrete mixes were in the proportion by weight of 1–2.40–4.32 and 1–2.29–4.12. The maximum size aggregate used was 1½ inches with three-fourths inch fine gravel. The average breaking strength of 135 28-day cylinders for the 1–2.40–4.32 mix was 3,500 pounds per square inch. The average breaking of 123 28-day cylinders for the 1–2.29–4.12 mix was 3,890 pounds per square inch. There were 307 6- by 12-inch cylinders cast from 101 test batches. Seventy-two of the cylinders were cast in cans and the balance were cast in molds.

The dumped rock riprap and rock fill were obtained from a boulder field area on the east side of the river about 2 miles southeast of the dam site. It was necessary to operate two shovels in the boulder area, one to load rock and the other to excavate and run the rock over a grizzly in order to separate waste materials.

All materials used in the construction of the dam were purchased by the United States and delivered to the contractor for installation. These purchases consisted principally of cement, reinforcing steel, steel sheet piling, cast-iron gates and operating machinery, cast-iron and clay sewer-pipe drains, structural steel, 48-inch plate-steel outlet pipes, radial gates, metal work, paint material, and other miscellaneous items.

Government forces installed 78 hydrostatic pressure indicators at various levels in the dam embankment. These pressure indicators will be checked at regular intervals in order to obtain data as to the percolation of water, if any, through and under the dam. The pressure indicators are wrapped in small sand bags and placed at the required elevation in 4-inch holes. Sealed copper tubing leads from the indicators to the crest of the embankment, at which point the tests are made. After location and desired position was determined, the hole between one indicator and the next level was sealed off in grout and the next level indicator installed. The indicators are located at 15-foot levels, and after installation there were as high as 6 indicators in one hole. The indicator lines across the dam are located at Stations 3+20, 4+40, and 5+40.

LOOKING ACROSS ALL-AMERICAN CANAL

The Central Valley Project, California[1]

NINETY-SIX percent of all California's water uses is for agriculture. California is an agricultural State. California, leading the Nation in magnitude of its irrigated area, has 4¾ million acres dependent upon irrigation. Of this amount, 3 million acres lie in the "Great Central Valley"—comprising the Sacramento and San Joaquin Valleys.

Under present conditions these irrigated lands in the Great Central Valley, the buildings on them, the farm implements, the irrigation works which supply them, and the preparation of them for irrigation, represent, according to the 1930 United States census, an investment of 1⅓ billion dollars. This figure does not include the investments in planting trees, vines, etc., which would probably add more than 600 million dollars, making a total investment of approximately 2 billion dollars.

These 3 million acres produce a combined crop and livestock income of 300 million dollars per year. Without water the land values and income would be nominal.

Of these 3 million acres, 1 million lack a full assured water supply to the extent that 20 thousand acres have already reverted to desert; 200 thousand acres are in steady process of reversion; and 800 thousand acres under ditches are not adequately protected against drought.

The Great Central Valley is surrounded by more than 40,000 square miles of mountains. The run-off from these mountains is ample in quantity not only for the present 3 million irrigated acres but for the ultimate 13 million acres that eventually may be developed. In spite of this abundant water supply, however, there exists under present conditions a serious shortage of water in some areas.

What are the reasons? There are two: First, the San Joaquin Valley has two-thirds of the irrigated area, while the Sacramento Valley has tributary watersheds producing two-thirds of the water; second, more than half of the combined waters escape as flood flows during non-irrigation seasons. Nature has provided water ample in quantity—she has left to man's ingenuity the regulation and distribution of that supply.

Protection and perpetuation of this 2-billion-dollar agricultural enterprise is the objective of the Central Valley project. With the realization of its importance, not only to California but to the Nation, the President, in December 1935, authorized the project as a national United States Bureau of Reclamation undertaking.

ENGINEERING FEATURES

The Central Valley project represents a major undertaking. The estimated 170 million dollars expenditure will be devoted to the construction of two large dams—one on the upper Sacramento River near Kennett, the other on the upper San Joaquin River at Friant, and to the construction of over 350 miles of main canals, together with booster pumping plants and diversion dams. Other related features are the required relocation of 30 miles of main-line railroad, the relocation of 13 miles of State highway, and the construction of Government camps with their related water supply and sewerage systems. The benefits from expenditures made during construction will not be confined to the immediate localities in which construction is under way, but will be extended to include practically every county of the State.

Under Federal reclamation practice, the usual procedure has been to extend the retirement costs over a 40-year period without interest, commencing with the actual availability of water. The cost will not be borne entirely by the users of irrigation, domestic, or industrial waters, since it is expected that substantial revenues will be derived from power developed by the stored waters.

Many visitors will be attracted to the project both during construction and after it is in operation.

STAGES OF DEVELOPMENT

Now you will ask, What is the program and what is being accomplished?

A project of this magnitude cannot be started overnight. Every major project must go through four stages of development.

First, the requirements must be analyzed. Activities along this line started in 1878 when the first broad study of the State's water problems was initiated by the first State engineer, William "Ham" Hall, an appropriation of $100,000 having been made for that purpose.

Second, the project must be visualized. An important forward step in this direction was taken when Col. R. B. Marshall, in 1919, submitted a coordinated plan. Through his personal efforts an appropriation of $50,000 was obtained from the State legislature. This was followed by successive appropriations and during the 12 years 1921 to 1933 the State expended nearly a million dollars in collection of data and preparation of reports. The Central Valley project became a definite project with the approval of the people in 1933.

Third, the final field surveys, exploratory work, final estimates of costs and plans for construction must be made. Upon this the Bureau of Reclamation has been engaged for the past year and with respect to some units of the project this work is now completed. Of major importance is the exploration of dam sites to determine the adequacy of foundation rock and its position; to do this tunnels and shafts must be driven; drill holes put down and careful geologic studies made. The dam site having been proved, the best type of dam must be selected and its cost estimated. In the exploration of dam sites 5 miles of tunnels, shafts, and drill holes have been driven by the Bureau of Reclamation in the past year. This work is practically complete and the dam sites have been selected and approved for construction. Surface surveys must be made for dams and appurtenant works, reservoir lands, camp sites, and canals. During the past year the Bureau has surveyed 7,800 acres of land and located 75 miles of canals. Railroads and highways traversing proposed reservoir sites must be relocated. The Bureau has completed relocation surveys for 30 miles of railroad to replace 37 miles of existing railroad in the Kennett Reservoir site and the State division of highways has resurveyed 13 miles of main highway. Appraisals of lands to be acquired must be made. There are several thousand separate ownerships in the project. The Bureau in the past year has appraised over 1,100 acres of lands and 43 miles of canal and railroad rights-of-way. Camp sites must be surveyed and camps designed, including camp water and sewerage systems.

The Bureau of Reclamation having made rapid progress in this work within the past year, the project, which has required over 50 years of study and 12 years of intensive endeavor, is now entering upon its fourth and final stage—that of actual construction. Commencing March 1, 1937, bids were opened at the Bureau's Sacramento office for six construction contracts, expenditures under which will total nearly 320 thousand dollars; one contract was for canal work in the Contra Costa division and the remainder for the Government camp at Friant. Contracts are in process of being signed and (as of May 13, 1937) instructions have been issued to two contractors to commence work aggregating nearly 94 thousand dollars.

[1] A 14-minute radio broadcast by the National Emergency Council.

Plans and specifications for works whose cost will exceed 40 million dollars are now in course of preparation and nearing completion.

Kennett Dam, to be over 400 feet high and rank as one of the world's highest dams, is an important feature of the project, since upon it will depend the conservation of floodwaters now wasting to the sea. The importance and magnitude of this structure is reflected in its cost which, together with the power plant and related features, will absorb nearly half of the entire project cost of 170 million dollars. Before construction of the dam can commence over 30 miles of existing railroad must be relocated to avoid the reservoir thereby created, which will occupy over 40 square miles of territory. Plan sand specifications are ready for the grading of one-half of this line and work will be advertised following a satisfactory agreement with the Southern Pacific Co. concerning its acceptability.

Friant Dam, to be 260 feet high and 4,000 feet long—one of the world's longest dams—is another important structure. Plans and specifications are ready for issuance, and construction will commence upon clarification of the situation with regard to lands and water rights. Simultaneously bids will be called for the first 6 miles each of Madera and Friant-Kern Canals, both of which will convey water from Friant Reservoir.

For the Contra Costa Canal it is expected to issue plans and specifications to include a 3-mile section in addition to the pending contract, the award of which has already been approved.

The years 1937 and 1938 should witness great construction activity on these major features as well as their related works.

Reservoir Storage Ample for 1937

The measurements of water stored in the Federal reservoirs at the beginning of May disclosed that whatever droughts or water shortages other lands may have, a good year generally can be expected in 1937 on oases that are the Government's reclamation projects in the West.

Securely held in vast reservoirs in anticipation of the hot, dry months is enough water to cover the State of South Carolina a foot deep or Indiana 10 inches. This will provide a supply of essential water to a total reclamation area of 3,000,000 acres, approximately the equivalent of the State of Connecticut.

A total of 19,626,017 acre-feet of water, 7,285,554 more than was impounded on April 30 last year, had been stored by May 1, 1937.

Prospects are bright for the reclamation projects. With the increase in storage expected during May and June, all projects with the exception of two will be provided with ample water for the coming irrigation season. The two which will suffer some shortage are the Belle Fourche project in South Dakota and the North Platte project in Wyoming and Nebraska, and the latter is in a much better position now than it was at this time last year.

These two projects are in the area of the Great Plains where drought has been severe several times in recent years. The parched ground of the watershed serving the Belle Fourche Reservoir, especially, absorbed a very high percentage of the rainfall there this winter. The run-off was disappointingly low. This reservoir, with a capacity of 198,100 acre-feet, contained 78,000 acre-feet last year on May 1, but had caught only 50,600 acre-feet by May 1, 1937.

There is sufficient water for good crops, but acreages on the Belle Fourche project will have to be somewhat curtailed. Water supplies are especially good for most projects, however. Several reservoirs had filled before the end of April and many of them are spilling this month.

The following table is a compilation of the water supplies available at the end of April:

Storage on Reclamation Projects (Acre-Feet)

Projects	Live storage capacity	April 1936	April 1937	Increase [1]
Arizona: Salt River	2, 120, 800	827, 204	1, 310, 953	+483, 749
Arizona-Nevada: Boulder	27, 179, 000	4, 343, 000	10, 929, 000	+6, 586, 000
California: Orland	101, 200	102, 340	100, 260	−2, 080
Idaho:				
Boise	631, 150	495, 340	433, 124	−62, 216
Minidoka	2, 658, 240	1, 923, 540	2, 319, 570	+396, 030
Montana:				
Bitter Root	33, 000	16, 000	2, 500	−13, 500
Milk River	135, 430	60, 549	10, 177	−50, 372
Sun River	143, 840	115, 806	44, 715	−71, 091
Nebraska-Wyoming: North Platte	1, 202, 460	308, 150	375, 190	+67, 040
Nevada:				
Humboldt	179, 000	6, 000	29, 232	+23, 232
Newlands	1, 026, 400	391, 060	432, 050	+40, 990
New Mexico: Carlsbad	47, 000	15, 800	17, 750	+1, 950
Texas: Rio Grande	2, 407, 000	776, 300	908, 600	+132, 300
Oregon:				
Baker	17, 400	17, 400	17, 400	----------
Umatilla	123, 660	78, 720	97, 180	+18, 460
Vale	249, 520	122, 435	90, 318	−32, 117
Oregon-California: Klamath	1, 081, 100	666, 930	616, 700	−50, 230
Oregon-Idaho: Owyhee	715, 000	712, 960	715, 000	+2, 040
South Dakota: Belle Fourche	198, 100	78, 000	50, 600	−27, 400
Utah:				
Hyrum	15, 260	14, 563	14, 819	+256
Ogden River	41, 090	----------	11, 793	+11, 793
Salt Lake Basin	74, 000	40, 665	52, 440	+11, 775
Strawberry Valley	270, 000	42, 300	68, 180	+25, 880
Washington:				
Okanogan	24, 900	5, 325	3, 353	−1, 972
Yakima	1, 045, 330	773, 480	614, 062	−159, 418
Wyoming:				
Riverton	31, 550	18, 875	18, 950	+75
Shoshone	459, 380	387, 731	342, 101	−45, 630
Total	42, 210, 810	12, 340, 473	19, 626, 017	+7, 285, 544

[1] −Indicates decrease.

THE choice lands in both the Mitchell Butte and Dead Ox Flat divisions, Owyhee project, Oregon-Idaho, are being settled rapidly. The Vale-Owyhee Land Settlement Association reports 16,000 acres, more or less, of new land sold on the Vale and Owyhee projects in 1936. This figure includes lands sold by real estate men and others, as well as sales by the association. They also report 840 acres sold in the Mitchell Butte division in March of this year.

Notes for Contractors

Specification no.	Project	Bids opened	Work or material	Low bidders: Name	Low bidders: Address	Bid	Terms	Contract awarded
724	All-American Canal, Calif.	May 7	Earthwork, canal lining and structures, including New River siphon, stations 3633+76 to 3825+97.	Sharp & Fellows Contracting Co.	Los Angeles, Calif.	[1] $269,721.20		June 7
				Southwest Welding & Manufacturing Co.	Alhambra, Calif.	[2] 109,737.00		Do.
729	Yakima-Roza, Wash.	do	Earthwork, bench flume, concrete lining and structures, Yakima Ridge Canal, stations 721+35 to 804+74, and 942 to 1120.	H. J. Adler Construction Co.	Caldwell, Idaho	175,137.00		June 2
731	Salt River, Ariz.; Parker Dam, Ariz. Calif.	May 10	Gate hoists for 50 by 50 feet spillway regulating gates for Bartlett, Mormon Flat and Parker Dams.	Consolidated Steel Corporation.	Los Angeles, Calif.	398,706.00		Do.
912-D	Milk River, Mont.	Apr. 23	Furnishing sand (8,500 tons) and gravel (15,500 tons) for Fresno Dam.	J. L. Shiely Co.	St. Paul, Minn.	[1] 14,400.00	F. o. b. Cole, Mont.	May 27
917-D	Salt River, Ariz.	May 12	Earthwork, canal lining and structures, Roosevelt power canal.	All bids rejected				
918-D	Colorado River, Tex.	do	2 bulkhead gate frames for diversion conduits at Marshall Ford Dam.	St. Louis Structural Steel Co.	East St. Louis, Ill.	10,630.00	F. o. b. East St. Louis, discount ½ percent.	June 2
919-D	Burnt River, Oreg.	May 13	Two 24- by 16-foot automatic radial gates for installation in spillway at Unity Dam.	Valley Iron Works	Yakima, Wash.	7,000.00	F. o. b. Yakima, discount 5 percent.	May 18
920-D	Casper-Alcova, Wyo.	May 14	Furnishing and delivering precast reinforced concrete pipe (18- to 60-inch).	Lock Joint Pipe Co	Denver, Colo.	[3] 25,700.00	F. o. b. Casper, Wyo., discount 5 percent 10 days.	June 11
921-D	Columbia Basin, Wash.	May 17	One motor-driven, vertical shaft, deep-well pumping unit, cap. 1,000 g. p. m., 140-foot head.	The Deming Co.	Salem, Ohio	1,411.85	F. o. b. Coulee Dam, Wash.	May 26
922-D	Central Valley, Calif.	May 20	Trickling filter for installation in sewage-disposal plant at Government camp, Friant dam site.	The Dorr Co., Inc	Los Angeles, Calif.	1,977.00	F. o. b. Denver and Los Angeles.	May 28
923-D	Boise-Payette, Idaho.	May 21	Structural steel for railroad bridge at station 797+88.46 Black Canyon Canal.	Virginia Bridge Co	Roanoke, Va.	4,642.00	F. o. b. Memphis, Tenn.	May 26
924-D	Moon Lake, Utah.	May 24	Clearing Moon Lake Reservoir site.	Sayles Construction Co.	St. Joseph, Mo.	21,662.00		June 9
925-D	Sun River, Mont.	May 21	One ½ c. y. clutch-operated, crawler-traction-mounted, Diesel-engine-powered, dragline excavator and one ½ c. y. dragline bucket.	Harnischfeger Corporation.	Milwaukee, Wis.	[4] 20,250.00	F. o. b. Milwaukee, discount 2 percent.	Do.
926-D	Upper Snake River, Idaho.	May 25	One 39-inch, inside diameter, welded plate-steel outlet pipe for outlet works at Grassy Lake Dam.	The Thompson Manufacturing Co.	Denver, Colo.	3,282.00	F. o. b. Ashton, Idaho, discount ½ percent.	Do.
42682-A	Salt River, Ariz.	Apr. 9	11,000 barrels of standard portland cement in sacks.	Monolith Portland Cement Co.	Monolith, Calif.	22,682.00	F. o. b. Monolith, 60 cents discount and sacks.	Do.
A-42230-A	All-American Canal, Ariz.-Calif.	Apr. 19	Steel reinforcing bars, 800,529 pounds.	Truscon Steel Co.	Los Angeles, Calif.	23,222.21	F. o. b. Calexico, discount ½ percent.	May 18
42689-A	Salt River, Ariz.	Apr. 29	Steel reinforcing bars, 986,596 pounds.	Colorado Fuel & Iron Corporation.	Minnequa, Colo.	28,702.40	F. o. b. Phoenix, discount ½ percent.	June 2
42235-A	All-American Canal, Ariz.-Calif.	Apr. 22	Steel sheet piling, 1,219,752 pounds.	Bethlehem Steel Co.	Bethlehem, Pa.	45,862.67	F. o. b. Yuma, Ariz., discount ½ percent.	May 25
27036-A	Milk River, Mont.	May 7	20,000 barrels of standard portland cement in cloth sacks.	Three Forks Portland Cement Co.	Denver, Colo.	50,000.00	F. o. b. Trident, Mont.	June 11
911-D	Owyhee, Oreg.-Idaho.	May 10	One direct pumping unit for Succor Creek pumping plant.	Dayton-Dowd Co.	Quincy, Ill.	6,073.00	F. o. b. Springfield, Ohio.	June 12
A-22025-C	Casper-Alcova, Wyo.	May 25	13,000 bbls. of Portland cement.	Monolith Portland Midwest Co.	Laramie, Wyo.	35,620.00	F. o. b. Casper	June 16
A-42250-A	All-American Canal, Ariz.-Calif.	May 17	Steel reinforcing bars, 800,033 pounds.	Colorado Fuel & Iron Corporation.	Minnequa, Colo.	24,026.26	½ percent b. p. v.	June 17
730	Boulder Canyon, Ariz.-Nev.	May 3	230,000-volt oil circuit breakers and disconnecting switches for Boulder power plant.	General Electric Co.,	Schenectady, N. Y.	[1] 156,485.00		June 21
				Pacific Electric Mfg. Corp.	San Francisco, Calif.	[2] 44,642.75		Do.

[1] Schedule 1. [2] Schedule 2. [3] Schedule 3. [4] Items 1 and 3.

New Filing System Installed Central Valley Project

A filing system for correspondence, reports, etc., standardized for project use has been devised by Earl R. Mills, chief clerk of the Central Valley project. Installation at the Sacramento headquarters office was accomplished by Mr. Mills and completed April 13, 1937. Installations at Antioch, Friant, and Redding on the Contra Costa, Friant, and Kennett divisions were accomplished by Assistant Clerk James F. Huchingson, Principal Clerk George H. Witte, and Assistant Clerk Wendall C. Miller, and completed May 25, 1937. The system as devised in manuscript form is in two volumes; volume 1 is the manual of instructions for installation and maintenance and volume 2 is the subject index.

In approving this system for installation on the Central Valley project, Construction Engineer Walker R. Young stated that the system devised was the result of untiring effort and a background of broad experience, as well as enthusiasm on the part of Mr. Mills.

Progress of Investigations of Projects

Blue River transmountain, Colorado.—Water supply studies were continued to determine the amount of water available for transmountain diversion with the various alternative project plans. Altitude-run-off curves were computed and plotted for the Williams River watershed and an estimate made of the monthly flow at the Leal dam site.

Colorado-Big Thompson, Colorado.—Hydrographic studies have been conducted to ascertain the releases from Granby Reservoir required to maintain satisfactory flow conditions along the Colorado River between Granby dam site and Hot Sulphur Springs. Studies were made to determine the effect of the proposed transmountain diversion and ultimate irrigation development within the Upper Colorado River Basin on stream flows at Lees Ferry, Ariz. Report on these investigations is nearly completed.

Eastern slope, Colorado—(*a*) *Cherry Creek surveys.*—Located east of Castle Rock, Colo. Topographic and land classification surveys were continued along the Cherry Creek Valley between the Castlewood dam site and Kenwood. Drilling at the two alternative dam sites near Castlewood was completed with the drilling of 7 holes at the upper site, and 10 holes at the lower dam site.

(*b*) *Trinidad irrigation and flood control.*—Topographic surveys on a scale of 50 feet per inch were completed for the dam site on the Purgatoire River.

(*c*) *South Republican River.*—Field surveys were practically completed for determining the possibilities of diversions for storage from the South Republican River and Landsman's Creek.

(*d*) *Apishapa irrigation reconstruction.*—Topographic surveys on a scale of 50 feet per inch have been completed for the dam site and are now under way on a scale of 500 feet per inch for the reservoir site.

(*e*) *Huerfano Canyon irrigation and flood control.*—Topographic surveys on a scale of 1,000 feet per inch have been completed for the reservoir site and on a scale of 50 feet per inch for the dam site.

Western slope, Colorado—(*a*) *Collbran project.*—Preliminary reconnaissance was made of the area above Collbran to outline plans for more detailed surveys to be started early in June.

(*b*) *Florida Mesa project.*—Topography on a dam and reservoir site through the Lemon property on the Florida River was begun at the latter part of the month.

(*c*) *La Plata project.*—General maps of the La Plata Basin in Colorado and New Mexico have been prepared.

(*d*) *Mancos Valley project.*—The report of this project was completed.

(*e*) *Paonia project.*—A reconnaissance was made on the Smith Fork of the Gunnison River.

(*f*) *Piceance Creek project.*—Topographic surveys were initiated for two reservoir and dam sites during the month.

(*g*) *Roan Creek project.*—A gaging station was established on the Dry Fork of Roan Creek.

(*h*) *Silt project.*—Stream gaging was continued, with six stream measurements being made on four creeks.

(*i*) *Troublesome Creek project.*—Reconnaissance surveys were made on the Main Troublesome and on the East Troublesome Creeks.

(*j*) *West Divide project.*—An automatic water level recorder was placed on the Jones Creek.

(*k*) *Yampa project.*—Water supply studies were completed and preliminary designs and cost estimates prepared for reservoirs of 6,000 acre-feet and 12,000 acre-feet capacity, respectively.

Rio Grande Basin, Colorado-New Mexico—(*a*) *Conejos River dams and reservoir sites.*—Field and geological examinations of the Bear Creek site on the lower Conejos about 5 miles below the no. 1 site indicate favorable conditions.

(*b*) *Wagon Wheel Gap Reservoir.*—Preliminary location and strip topography on the highway relocation around the reservoir have been completed.

(*c*) *Lower San Juan Valley.*—Reconnaissance of irrigation possibilities on the Lower San Juan was continued throughout the month.

(*d*) *San Juan-Chama transmountain diversion.*—Surveys for an alternative location for the San Juan-Chama diversion were virtually completed during the month.

(*e*) *State Line Reservoir and dam sites.*—The preparation of preliminary designs and estimates for concrete arch type dams at the Ute Mountain site was begun.

Boise (*Boise-Weiser-Payette*), *Idaho.*—Two planetable parties were engaged throughout the month taking topography on the area to be classified and the preparation of base maps for use in the land classification. During the month these surveys were completed for the Mountain Home, Weiser, and Payette Valley lands, and part of the Dry Creek area. Detail land classification surveys have been completed for 39,400 acres within the Mountain Home area. One hydrographer and five gage readers, working in cooperation with the United States Geological Survey, secured data on stream flow in the Weiser River Basin. The detailed survey of the two dam sites at Garden Valley on South Fork of Payette River was continued throughout the month. The detailed survey of the Twin Springs dam site, on Middle Fork of the Boise River, was continued throughout the month. Additional data have been secured on the portions of the railroad and highway which fall under the proposed flow line of the Carbarton reservoir site. Some preliminary surveying was done on Cascade reservoir site which is located on the North Fork of Payette River just above the town of Cascade.

Madison River diversion, Montana.—Classification was continued throughout the month on the land on the west side of the Madison River. The classification of all land on the Madison River watershed was completed and the altimeter topography completed on most of the irrigable land.

Altus project surveys, Oklahoma.—A reconnaissance was made of the project early in the month and plans formulated for more detailed investigations. Preliminary geological studies are now being made of the reservoir and dam site. A total of 35,000 acres had been classified during the month.

Grande Ronde investigations, Oregon.—Specifications were prepared in the Denver office with a view of having aerial mapping work performed by contract. A ground-water survey of the valley was begun on May 7, 1937. The plan followed was to bore 2-inch diameter soil-auger holes at approximately one-half mile intervals, along fence lines at points where they could be easily found, and least disturbed.

Black Hills investigations, South Dakota—(*a*) *Angostura project.*—Work was continued on the studies and revised preliminary designs for the Horse Camp Dam in an effort to reduce the total estimated cost for this structure. Revisions in the design and capacity of the spillway structure and provisions for an emergency spillway are being made for a general plan to cost approximately $3,250,000.

(*b*) *Rapid Valley project.*—Additional topography has been obtained and test pits dug at the Pactola and Deerfield dam sites. A report is being prepared on the general water resources of the Hills, the mean annual rainfall for the area as a whole, and for the individual watersheds.

Utah—(*a*) *Blue Bench investigations.*—Work was resumed on the preliminary location of an upper canal diverting from Rock Creek at elevation 7,540 feet and

(Continued on p. 168)

The Noxious Weed Control Program on the Shoshone Project, Wyoming

By C. L. Corkins, State Entomologist

THE noxious weed program now in progress in Wyoming was inaugurated the summer of 1933 by our department upon the request of farmers of the Shoshone project in Park County. Previously, the Extension Service had accomplished much by calling the problem to the attention of the farmers and holding demonstrations of the best methods of control then known. However, individual effort soon seemed in vain and the weeds continued to spread at an alarming rate, variously estimated at 100 to 400 percent per year.

At that time, the Wyoming Pest District law provided that the entire expense of control work on pests in organized districts had to be borne by the farmers. As the costs of noxious weed eradication ran from $40 to as high as $600 per acre, only an enforced seeding control program was inaugurated and farmers were given their choice in asking for the expensive eradication treatment.

Two years of experience under this old law and organization pointed out clearly the following facts:

1. A portion of the expense of weed eradication must be borne by public funds, or else an enforced eradication program would be confiscatory. This resulted in a new State law, which now divides the expense equally three ways—to the State, to the county, and to the individual.

2. Continuous clean cultivation is the only feasible program of eradication for large acreages of weeds.

3. Due to the fact that the type of cultivation required to successfully eradicate noxious weeds greatly disrupts ordinary farm practices and requires expensive equipment not available on the average farm, the only really successful way to handle this program is by means of county equipment operated by county crews. Our observations indicated that not over 5 percent of the individual farmers would successfully complete a job of clean cultivation.

4. The job of chemical control is too technical for the average farmer to use successfully.

5. The then known methods of chemical control needed improvement to be sufficiently effective to justify their use.

6. New and improved specialized equipment was necessary for the most efficient and economical eradication by cultivation.

7. Organized pest control districts and law enforcement are essential to success in a noxious weed control program.

8. A stringent noxious weed seed law should be a part of the program. Such a law was passed by the 1937 session of the Wyoming Legislature.

9. Trained weed specialists to operate a weed district are vital. This has been one of our greatest problems in the expansion of the program in Wyoming.

With these vital factors in mind, we started in earnest an eradication program on the Shoshone project in the spring of 1935. Two clean cultivation units were placed on double shift, working 16 hours a day. By the fall of 1936, out of the 259 acres under clean cultivation, 227 were completed and ready to go back into crop. In another county, 190 out of 196 acres were completed. The acreage not eradicated, of course, will not need a full program for 1937 to complete eradication.

The chemical work with sodium chlorate, is not so promising, especially with White Top on heavy, alkali ground. Because we have attempted on the Shoshone project to eradicate White Top under these situations, our chlorate work has been only about 60 percent effective. The figures for 1935, our worst year, show that 4,762 out of 8,750 square rods were completely eradicated. Now that we have largely abandoned treatment of White Top under these conditions and have changed our treatment methods, the results of the 1936 work apparently will run well over 90 percent on the use of straight sodium chlorate, applied only to barren ground late in the summer and fall.

The chemical treatment with carbon bisulphide is running about 98 percent effective. It, however, cannot be used on large patches, due to the cost, nor on very sandy, gravelly, or adobe soils.

Detailed description of the chemical methods must here be deleted. But we feel it is important to state our experience has taught us that the methods of application previously recommended have not given us satisfactory results. Our conditions may be different from other States. At least, we have had to change our methods to obtain results that would justify the continued use of chemicals.

Since the continuous clean cultivation method is the keystone to our program and because our method seems to differ from that employed elsewhere, the balance of this article will be a quotation of the cultivation instructions to our weed district officials as taken from our "Wyoming Manual of Noxious Weed Control", prepared primarily for the guidance of hired workmen on the job. These, we believe, will form a reliable basis of work for anyone wishing to use this method of noxious weed eradication.

FIELD TAKEN BY RUSSIAN KNAPWEED

CLEAN CULTIVATION EQUIPMENT

The continuous clean cultivation operation is one which requires extraordinarily good equipment, both as to cultivators and tractors. The types with which we have had experience are here briefly discussed.

Cultivators.—1. Drube Special. Manufactured by the Drube Machine Shop, Wheatland, Wyo. This machine is the most satisfactory deep tiller cultivator available, as it was designed and built in cooperation with our officials and for this special job. Made to order. Standard size, 7 foot, 2 gangs with 6- to 15-inch duck feet on front, and 7 in rear. Power take-off worm and gear power lift. Universal hitch to tractor. Takes Planet Jr., Case, or Killifer sweeps. Power

necessary: 30 horsepower on drawbar. Rubber tired. 86-inch truck.

2. *Case deep tiller.*—Manufactured by J. I. Case Co. This machine has to be rebuilt to be satisfactory and mounted on rubber. Weakness is in breakage of axles and power lift, side tilt of gangs due to narrow wheel base of trucks, and in inability to make sharp turns with sweeps in the ground. This, however, is the second best tool we have used for fast, high-power work. Power necessary: 30 horsepower on drawbar.

3. *Oliver deep tiller.*—A very unsatisfactory tiller. After 2 years' experience with this machine, we cannot recommend it. More adaptable to an individual farmer's needs than to the weed program.

4. *Oliver fallovator.*—This tool, when braced and mounted on rubber tires, is a very satisfactory tool for slow equipment. Not to be run to exceed 4½ miles per hour. Ten-foot machine recommended for 20 to 25 horsepower on drawbar crawler tractor. A 7-foot machine recommended for 8 horses or 15 to 20 horsepower wheel tractors drawbar rating. Use 14-inch duck-foot sweeps.

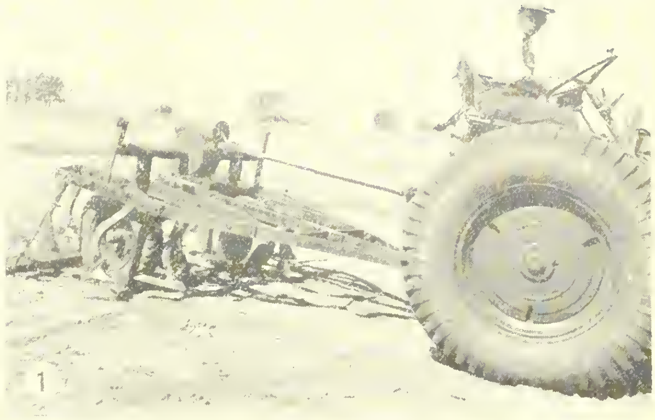
Tractors.—All rubber tired tractors should have industrial over-drive gears, so that 4 speeds forward, up to 15 miles per hour are obtained, with a minimum of 6 miles per hour in third gear. Also, the power minimum on the drawbar is 30 horsepower, Nebraska rating. All should also be equipped with maximum size tires, preferably 13½-inch rear.

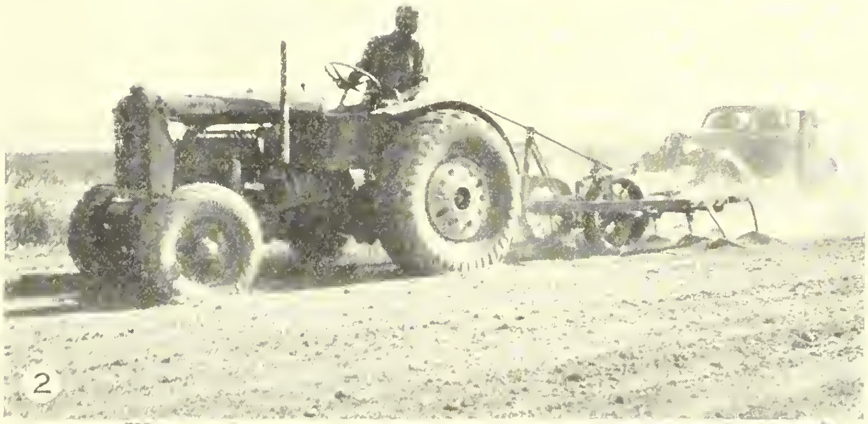
1. *J. I. Case model L.*—The most satisfactory tractor thus far used.

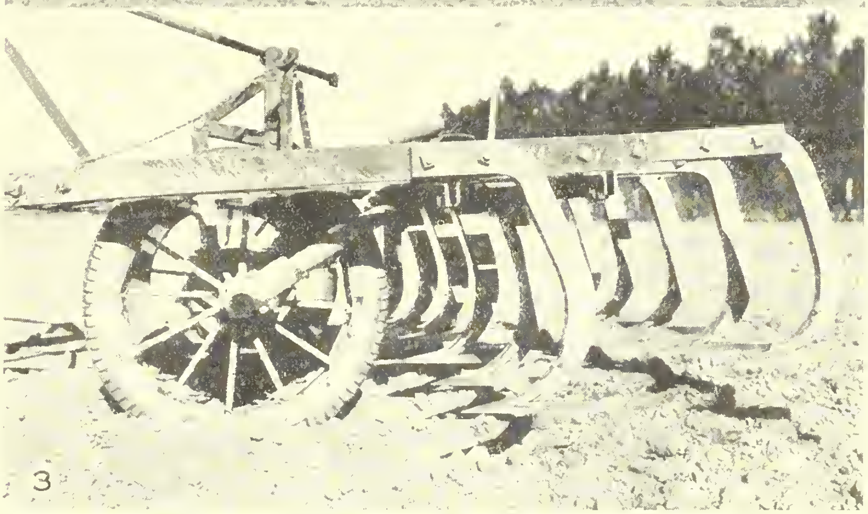
2. *Allis-Chalmers model U.*—Slightly under-powered and motor speed a little too high, but has been a very good tractor. Third gear speed too low, requiring speeding of motor to obtain 6 miles per hour in field. New model a little too low on road speed.

3. *McCormick Deering W. 30.*—Not recommended. WK 40 now under field test.

4. *Caterpillar 22, Crawler.*—Very satisfactory for 10-foot cultivators where large acreages are involved and traction is poor for rubber jobs. Usually run at only 4 miles per hour.







1. DRUBE "SPECIAL" CULTIVATOR; 2. CASE DEEP TILLER; 3. CLOSE-UP OF CASE DEEP TILLER

DUCK FOOT SWEEPS

Two gangs of 14- or 15-inch sweeps must always be used. The sweeps should be mounted as close to 3 inches apart as is possible and still provide clearance of trash at 5- to 6-inch depth of set. If more than this is necessary because of trash, it will pay to rake and burn it. A 2-inch spacing is better if trash will clear.

The sweeps should be kept sharp at all times. Ordinarily they must be changed after 6 to 12 hours of operation, and sharpened. Sharpening twice on an emery wheel powered from the tractor pulley, in some cases has proved economical and helpful. They must then go to the shop. In any event, do not use tools that are so dull that plants are dragged under instead of being cut off smoothly.

The average life of a set of sweeps is about 200 hours of work, varying with the nature of the soil. When cultivation units are run double shift, the sweeps will have to be replaced, ordinarily, each 10 days to 2 weeks, and sometimes oftener. This should be anticipated and an adequate supply of sweeps kept on hand.

The most satisfactory brands of sweeps which we have used are the Oliver, Planet, Jr., and Killifer. The Killifer sweeps are the best, but their cost more than offsets their advantage in longer life. Only the latter two fit the Drube Special and the Case Deep Tiller without changing the holes in the tiller shanks.

CONTINUOUS CLEAN CULTIVATION

1. *Advantages over chlorate methods.*—(*a*) One-fourth to one-sixth the normal cost.

(*b*) Improves the soil, both physically and chemically, leaving it in a maximum state of tilth for crop production where eradication of weeds has been accomplished. The physical improvement is obvious. The chemical change is brought about by a demonstrated increase in nitrogen in the soil, due to an improved habitat for free living nitrogen producing bacteria in the soil.

(*c*) 100-percent eradication by this method can be guaranteed, whereas only 50- to 95-percent eradication is accomplished by the chlorate method, depending upon conditions.

2. *Cost factors.*—Naturally the cost factors of clean cultivation vary with conditions, but in 85 percent of the cases on areas of 2, 3, or more acres, eradication will be completed in 2 seasons of 35 to 45 cultivations, in which event the normal cost will run from about $35 to $50 per acre. In other words, the normal cost runs about $1 per acre per cultivation. The more important variable factors which may raise or lower this normal cost of cultivation are:

(*a*) Size of infested area: Obviously, areas under 2 or 3 acres will require more time per unit area, due both to less efficiency in cultivation and increased overhead due to the fixed cost of moving equipment.

(*b*) Nature of the soil, heavy or stony soil requiring more time and causing more wear on equipment.

(*c*) Species of weed involved: Russian Knapweed and Bindweed require a larger number of cultivations than White Top and Canada Thistle.

(*d*) Depth of soil to sterility or water table: If well established, roots of these weeds will penetrate the soil to a sterile bed of sand or gravel or to the water table. If these are relatively high, the root systems therefor are shallow and will be more quickly starved out by cultivation.

CORN GROWING IN FIELD AFTER RUSSIAN KNAPWEED HAD BEEN ERADICATED BY CLEAN CULTIVATION

(*e*) Age of the weed area: Naturally, the root systems of new infestations are not as deep and extensive as those of old ones and are consequently eradicated with less cultivation.

(*f*) Water content of the soil: Soil which tends toward bogginess or holds a large amount of water, or is well saturated with water during the winter period, especially, tends to break down the root systems of these weeds under cultivation much more rapidly than dry soil. This is particularly true during the winter breakdown period, when the partially carbohydrate or starch starved roots which are emaciated due to the previous summer's cultivation, are subjected to bacterial decay during periods of alternate freezing and thawing.

(*g*) Physical character of the soil: Roots break down more rapidly under clean cultivation in heavy soils than in light. The reasons for this are not clearly understood, but doubtless moisture-holding content is one factor.

(*h*) Wage rates and type of equipment used: With a combination of favorable factors for cultivation eradication, the period may, in a few cases, be reduced to 1 year with about 18 cultivations. With the reverse, a few cases will take 3 years with 55 cultivations.

3. *Time of year to initiate cultivation.*—There are two periods of the growing season when it is feasible to start cultivation, and it is not yet certain which is the better. As a consequence, it is well to let the land owner exercise a choice in the matter, if he wishes. Otherwise, the county pest inspector will try to work this out so that the two groups will be as near 50–50 as possible, in order that valuable experimental data will be evolved.

(*a*) Early spring: Areas should be broken for cultivation just as soon as possible after green vegetation shows, or better, before the plants are up, if the boundaries of the infested area are previously known. It is likely that starting at this period will necessitate a few more cultivations than otherwise, but the chances are 8 to 1 that the area can go back into crop the third season, which is an item of no little account.

(*b*) Midsummer or peak of development of plant: This period to start breaking out a weed area varies as to time, according to the weed species involved. The point is to begin the attack at the time the plants have spent their maximum energy in the reproduction process and are weakened thereby. Normally, this is when the seeds have reached the stiff dough stage. This procedure will reduce the number of total cultivations necessary, but the chances are about even that the area can go back into crop the third season. In other words, it is likely

LEFT SHOWS ROOTS OF RUSSIAN KNAPWEED AFTER ONE YEAR OF CLEAN CULTIVATION; RIGHT, ROOTS OF RUSSIAN KNAPWEED IN NORMAL STATE WITHOUT CULTIVATION.

that 50 percent of the acreage will have to be cultivated into the third season, thus increasing the net cost to the farmer by the loss of one additional year's crop on about 35 percent more of the acreage than if the other procedure were followed. A larger percentage of Russian Knapweed and Bindweed than other weeds will re quire 3 years by this method.

4. *Depth of cultivation.*—The depth of the first cultivation should be 5 inches. Each succeeding cultivation should be a fraction of an inch deeper, until a maximum of 6 inches is reached. Always keep the sweeps working against an unbroken, firm base of soil so that the cut will be clean. Never cultivate to a depth of less than 5 inches. To cultivate deeper than 6 inches is apt to roll so much soil over the sweeps that the increase of power required will offset any savings in length of time between cultivations.

5. *Frequency of cultivations.*—This will vary with such factors as weed species, nature of soil, time of year, number of previous cultivations, and others. However, the important point is that *no green regrowth should ever be allowed to see the light of day.* This is so important that any county pest inspector who habitually fails to prevent above surface regrowth without good cause will be summarily dismissed from the service.

At the beginning of the cultivation program, ordinarily Bindweed and Russian Knapweed will have to be cultivated every 5 days. White Top and Canada thistle will hold about 7 days. These periods between cultivation will gradually lengthen.

The only safe procedure for the inspector to follow is to make frequent examination of each plot and a routine of the rounds of cultivation which will insure arrival at the areas of faster regrowth on time, even if others are cultivated a bit more frequently than would seem necessary.

6. *Preparation of infested area for cultivation.*—(*a*) Layout: Be sure to cultivate out at least 12 feet beyond the edge of the area where the last plants are found. Failure to do this is one of the most common and disastrous procedures of inspectors, and is not to be further tolerated.

(*b*) Clean of trash: Trashy areas should be raked and burned. If there is also much undecayed trash in the soil, it is often necessary to have a laborer clear, pile, and burn trash behind the bull-tonguing. In any event, trash must be removed which will not clear the sweeps when set 3 inches apart.

(*c*) Breaking out: Ordinarily this can be done more efficiently and cheaply with bull tongues on the deep tiller than by plowing. In bull tonguing, it is often necessary to criss-cross the area once or twice, or from two to four cultivations. But this is usually better than plowing. Use the plow only in extreme cases, to wit: heavy sod or alfalfa. In either event, do not break the soil out to a depth of more than 5 inches. This will leave a firm base upon which to work the sweeps.

7. *Fall irrigation.*—Unless the soil is normally wet, give a heavy fall irrigation following the last cultivation to all cultivation plots when eradication is not yet complete, if water is available. This will give aid by:

(*a*) Assisting in the winter breakdown of the root system, and,

(*b*) In germination of seeds in the ground, the seedlings of which will be destroyed by later cultivation.

8. *Seasonal duration.*—(*a*) Spring: Until eradication is complete, the initial spring cultivation should be started when the shoots are still 2 inches from the surface of the ground. This will insure a complete round of the cultivation over all the weed areas being treated before any green leaves appear, *which is essential.*

(*b*) Fall: Cultivation is continued in the fall until all regrowth is halted by cold weather. In some cases this means mid-October.

9. *Follow crop and spot treatment.*—(*a*) Crops: For 2 years following the completion of a clean cultivation program on a given area, the land must be placed in a row crop, preferably sugar beets or beans. This will give an opportunity to locate any individual plants or spots of return of infestation.

(*b*) Spot treatment: For any such return of infestation, use the carbon bisulphide "Spot Treatment."

Sheep Spread White Top

Sheep moving from farm areas infested with White Top onto farm areas with clean soil, according to Project Manager Tuller, have been a large factor in spreading White Top on the Boise project.

"Infestations of White Top", states Manager Tuller, "can be traced along all the routes that sheep have taken to their summer pastures when they have come from infested areas. Some of the heaviest stands of whitetop on the Boise project have been on the upper side of the New York Canal where sheep have been trailed. Some areas of White Top are found a mile out from the canal in the sagebrush."

"Effort has been made on the project, however, to inform project farmers of this source of infestation. At the time Ada County had an agricultural agent he was considerably active in preventing the movement of sheep from infested areas into areas where there were no infestations of White Top. The information was so widely spread among the water users that they are still very careful from what areas sheep come that move onto their farms."

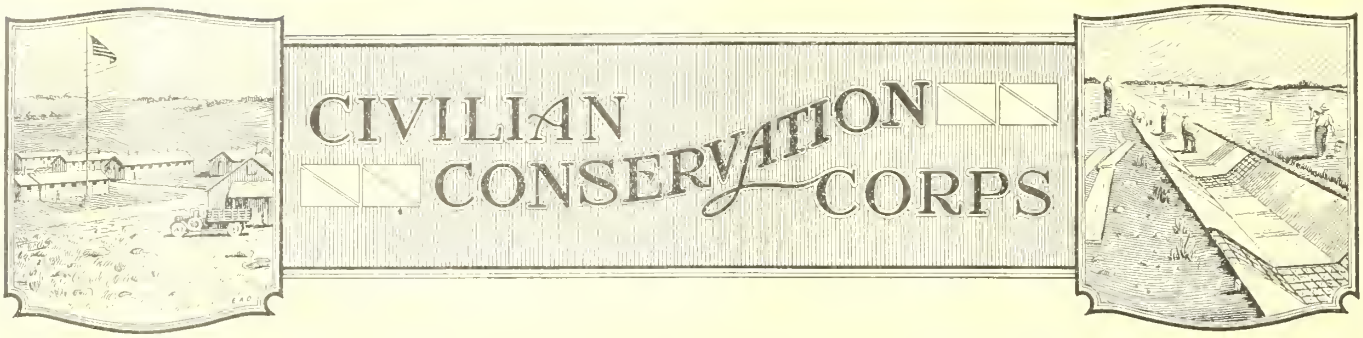
"White Top," according to the Idaho Extension Bulletin on Perennial Weeds, "seeds abundantly, has creeping rootstocks, and is rapidly becoming a serious weed pest in many sections of Idaho. Although it thrives on all types of soil, it seems to prefer slightly alkaline conditions."

The University of Wyoming Agricultural Extension Service in Circular No. 33 reports, "White Top is rapidly spreading in the irrigated areas in the western half of Wyoming. It is without question one of the most difficult weeds to control and eradicate in Wyoming. Due to its persistency when once established and the fact that it produces seed abundantly, it is spreading rapidly in the localities where it has been found. Because White Top is one of the most noxious weeds in the State, every precaution should be taken to avoid infestation and to stamp out all weed areas before they gain a foothold."

The problem of preventing the spread of White Top and other damaging noxious weeds by livestock is a wide one, but, needless to say, if it is known that stock have been pastured on heavily infested areas either on farms, the range, or ditch banks, or have been given green feed or hay heavily polluted with noxious weeds, they should not be allowed to run over the farm to infest clean soil. Such stock should be confined to pasture where measures can be taken to prevent these noxious weeds seeding and control them so far as possible from spreading into crop fields.

If even a small patch of White Top or other primary perennials are discovered on a farm, considerable labor and expense will be saved if measures are taken at once to eradicate this patch before it spreads to other parts of the farm. Detailed information on eradication procedure such as kind of chemicals effective for different types of weeds and soil conditions and methods to follow for killing noxious perennial weeds by root cutting, as these apply to your locality, may be obtained from your local county agent or the extension service of your State agricultural college.

A CONSIDERABLE amount of farm property on the Minidoka project, Idaho, changed hands during March. Sales included a 40-acre tract, 1½ miles north of Rupert, for $4,500; 80 acres, 3 miles southwest of Rupert, for $3,750; 40 acres, 2 miles southwest of Rupert, for $3,250; two 40-acre farms near Paul for $3,600 each; 80 acres, 3½ miles north of Rupert, for $5,500 in cash; 35 acres near Paul for $2,000; and others.



CCC Erosion and Flood Control Program, Rio Grande Project

By W. P. Mealey, Jr., Superintendent, Camp BR–39, Las Cruces, N. Mex.

FLOOD waters reaching the valley lands of the Rio Grande Federal Reclamation project have been one of the major problems in connection with the operation and maintenance of the project. These floods are caused by rainstorms, which at times reach cloudburst proportions, over the mesa lands and mountain regions lying on both sides of the Rio Grande, doing heavy damage to the irrigation and drainage features, and to farm lands of the project

With the establishment of Camp BR–39 at Las Cruces, N. Mex., it was believed that the employment of Civilian Conservation Corps enrollees offered an excellent opportunity to accomplish effective and badly needed flood control on the worst arroyos of the project. The Picacho Arroyo was chosen as the first to be brought under control. This arroyo enters the Rio Grande valley about 6 miles northwest of the town of Las Cruces and has an immediate drainage area of some 5 square miles. During the rainy season successive flows of rain waters from this arroyo several times each year wash out the Picacho Canal and encroach on the farm lands lying adjacent to its mouth to such an extent that several hundred acres have been rendered useless for farming and some 400 more acres are seriously threatened.

TOP: UPSTREAM FACE OF APACHE DAM. BOTTOM: DOWNSTREAM FACE OF DAM

THE APACHE DAM

The Apache Dam was the first major structure to be constructed by the enrollees. This structure is a masonry gravity-arch type flood detention dam. It is 49.5 feet from stripped foundation to top of parapet walls with a crest length of 153 feet and a base length of 30 feet. The thickness of the base is 34 feet with a top width of 10 feet, having an O. G. spillway crest.

The total combined volume of concrete and masonry is 3,211 cubic yards. An earth embankment extension on the south end of the dam is 264 feet long and contains 7,490 cubic yards with a concrete core wall through the entire length. The Apache Dam creates a reservoir capacity of 142 acre-feet and has an ample overflow crest for possible extraordinary floods. All ordinary floods are expected to be controlled by a 24-inch bleeder pipe through the main section of the dam. A small grade-check dam was built immediately below to prevent any possible backwash below the main structure. A short distance below the main dam there are some 400 acres of comparatively flat terrain, which has been contour terraced and to which water will be diverted by means of a combination check and diversion dam placed across the main arroyo channel.

It is expected that within a few years, with the planting and encouragement of the growth of native shrubs and grasses, this terrain and arroyo channel will produce a cover growth of sufficient density to prevent erosion.

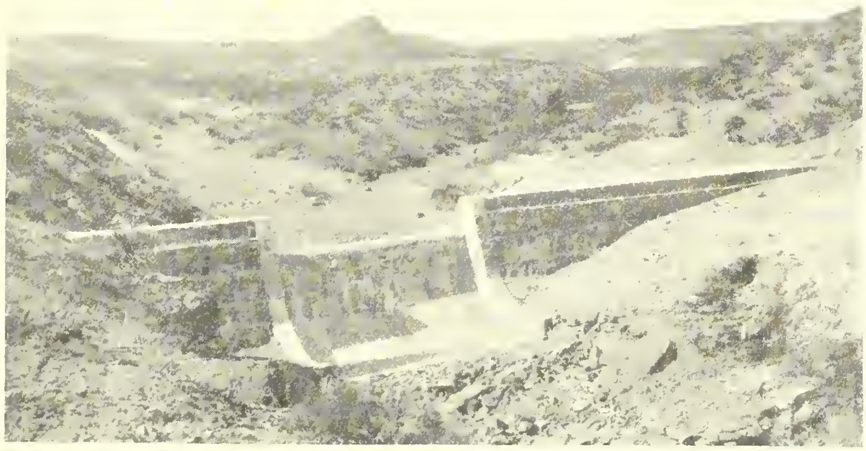
About 1¼ miles above the reservoir a small detention dam, 15 feet in height, was constructed to create a settling basin for the purpose of lessening the silt deposit in the main reservoir. All the smaller structures are also of stone masonry construction.

The site of the Apache Dam was a water gap through an upturned formation of stratified limestone. The foundation and abutment excavation were blasted from 4 to 6 feet into the solid limestone. A 125-cubic-foot compressor and two small jackhammers were used for drilling, excavated materials being removed by hand and the larger rock set aside to be used later in the masonry of the dam. All concrete was mixed in a 7-cubic-foot mixer with an elevating hopper. The mixing plant was set up on a ledge overlooking the site on the south abutment about 25 feet above the stream bed and all concrete placed by steel chutes. When construction had progressed to the point where gravity delivery was no longer possible the south abutment fill was made and the plant placed on it. A trestle was built across the dam and concrete was trammed to hoppers. Steel chutes carried the concrete from the hoppers to where it was needed.

The two faces of the Apache Dam were constructed of rubble masonry and the core of cyclopian concrete placed in 2-foot lifts. Because insufficient rock was available at the dam site, rock was gathered and quarried within a radius of 2 miles and trucked to the job. Smaller concrete aggregate was obtained from a pit in the Picacho Arroyo about 2 miles from the dam. Bank run aggregate was used without screening.

The embankment materials were placed by truck and the trucks loaded from a trap which was fed by a 50-horsepower caterpillar Diesel with an angledozer. An 8-inch concrete diaphram wall was constructed by the C. C. C. boys along the center line of the fill for its entire length and was carried from rock in place. This wall was formed and poured in three successive lifts as placing of the fill progressed. Upon completion the fill was ponded with water pumped from the arroyo and penetration was aided by the use of jets. The use of water on the fill was limited to such times as the arroyo was running. All water for construction had to be hauled from Las Cruces.

Before the Apache Dam was completed it was decided to continue the flood control on the south fork of this same arroyo.



TYPICAL SUPPLEMENTAL CHECK DAM

An excellent dam site was found for a detention dam of somewhat larger proportions than the Apache Dam. This structure, known as the Box Canyon Dam, is now about 65 percent complete, and is similar in construction to the Apache Dam. It contains 3,500 cubic yards of concrete and masonry, with a 1,050-foot embankment containing about 18,000 cubic yards of earth. The main portion of the dam will be 49 feet high, 220 feet long with a bottom thickness of 34 feet and a top thickness of 10 feet. A flood spillway will be excavated around the north end of the dam in solid rock and a 24-inch square bleeder tunnel through the dam 16 feet above the stream bed will take care of normal run-off. By placing the bleeder tunnel 16 feet above the stream bed a permanent impoundage of 24 acre-feet will be created and the capacity of the reservoir to the flood spillway elevation will be about 250 acre-feet. Immediately below the main dam a grade check dam 6 feet high will be constructed. The drainage area above this dam will be between 5 and 6 square miles.

The Box Canyon Dam is located in a steep canyon cut through a series of successive andesite flows. The rock is faulted and altered and foundation grouting was considered necessary. A series of 1¼-inch holes at 10-foot centers were drilled on the axis of the dam to a depth of 20 feet and pressure grouted at 150 pounds per square inch. A 4 by 6 grout pump operated by compressed air was used.

The footing and abutment excavation is carried a minimum of 4 feet into solid rock and excavated materials removed by hand. The concrete and masonry section of the dam is the same as the Apache Dam and construction was carried on in the same manner.

The embankment materials are trucked to the fill and the fill placed in 2-foot layers, compaction being by a sheepfoot roller drawn by a 35-horsepower tractor. Trucks are loaded by a three-fourths cubic yard dragline borrowed from the Bureau of Reclamation and operated by a skilled operator. No water is available for use on the fill, all water for construction is hauled from Las Cruces.

CONTOUR TERRACING

Contour terracing on the area below the Apache Dam was accomplished by the successive use of a road grader and a 50-horsepower Diesel tractor, equipped with an angledozer. Terraces were constructed on the upper and steeper portions of the terrain on 2-foot contours, and extended to 4-foot contours as the canyon widened and the slope became less steep. Seed for a number of native plants and grasses is on hand and will be planted as soon as moisture conditions permit.

The original quota of C. C. C. enrollees assigned to this work were from central and east Texas farms, with little or no skill or experience in any type of construction work. It was, therefore, necessary to do considerable training before work of any magnitude could be attempted. The two check dams below the Apache Dam were constructed during this period of training. Check dam no. 1 was a rock masonry structure used as a combination check and diversion dam, and is 9 feet high by 78 feet long. It was constructed across the main arroyo channel, and the foundations are laid on gravel. The footings were carried to a depth of 4½ feet below the stream bed, which was considered sufficient for a dam of this size and type.

Check dam no. 2, built immediately below the Apache Dam to serve as a grade retainer, and check dam no. 3,

(Continued on p. 168)

Successful Cattle Feeder, North Platte Project

By T. W. Parry, Manager, Pathfinder Irrigation District

F. M. ATTEBERRY, the outstanding cattle feeder of this section of the United States, is a landowner and water user under the Pathfinder Irrigation District.

Mr. Atteberry owned 10,000 acres of nonirrigated grazing land adjacent to the North Platte Reclamation project and was engaged in raising cattle for market. In 1910 he purchased about 200 acres of irrigated land, located on the project and adjacent to his grazing land, with the intention of raising hay to winter the cattle raised on the nonirrigable grazing land. The irrigated unit contained some fair land, but the big majority of the acreage was generally low grade—sandy with some gravel hills and steep slopes, and with a sand draw running across the north half of the unit. More than half of the irrigable acreage was in native sod and had never been "broken out."

In the beginning the land that had been cultivated was seeded to alfalfa and grains. Gradually more of the sod was plowed up and seeded. Field laterals were located and constructed in accordance with the topography of the lands to be irrigated. Then the work of land leveling begun, fields were placed on a more uniform slope, and as this was accomplished the field laterals were relocated and the irrigation simplified and improved.

Land leveling was spread over a number of years and is still being continued. At the present time, the steeper slopes are being leveled out to prevent scouring of laterals and furrows and to make the best use of the irrigation water.

The principal crops now being raised on this farm are alfalfa, sugar beets, and potatoes, but all of the different kinds of crops grown in the valley are produced on this farm.

During the fall, winter, and early spring the farm lands are roughened with a disk or other tools to prevent wind erosion and preserve the moisture. This process is continued as often as the need arises. Dikes were built across the sand draw at different points to catch and hold the silt and let nature assist in leveling the land and also to keep the top soil from being washed away.

BARNYARD MANURE INCREASES SOIL FERTILITY

During all this time the fertility of the soils has been increasing owing to the annual and continued application of barnyard manure from 500 to 700 head of cattle with the result that this farm is one of the most consistent high producers of the project.

As an example, this farm has produced: 22 tons of sugar beets per acre; 3.5 tons of alfalfa hay per acre; 85 bushels of barley per acre.

During the year 1936, which was a short water year, one 20-acre tract of land that had been considered practically worthless, produced 200 bushels of number one grade potatoes per acre. Although this yield is by no means high, it is remarkable for land that was considered worthless only a few years ago. There is a potato cellar 38 feet wide and 82 feet long with a capacity of 15,000 bushels. The walls are of concrete and are sloped at the top as an added protection from frost.

But the principal business of this farm is cattle feeding. Mr. Atteberry keeps 500 to 700 head of cattle in the feed lots the year around. As soon as one lot is shipped it is replaced by another bunch.

Until 4 years ago this farmer raised his own cattle to feed. At that time he discontinued the raising of cattle and devoted his entire time to feeding and finishing cattle for market.

CATTLE CAREFULLY SELECTED

The cattle that now go into the feed lots are all purchased from cattle raisers in this vicinity, and are as carefully selected as though they were to go into the show ring. Only steer calves and "short" yearlings are fed and those have all been Herefords until this year when one lot of 195 head of black Angus steer calves are being fed.

The cattle are never allowed out of the feed lots and are kept on special feeds from 5 to 6 months or until they are choice to prime and have that fine silky appearance that only those feeders who have a genuine love for fine cattle seem able to attain. If the cattle are wild when they arrive, they soon learn they have nothing to fear and Mr. Atteberry can walk among them without disturbance.

When the cattle are ready to be marketed they are shipped and sold in the Chicago market, where it is the rule rather than the exception, to sell at a premium. Mr. Atteberry's cattle have "topped" the Chicago market 74 times in the past 5 years. In 1932 he shipped 21 carloads and "topped" the market on each of 10 shipments. In 1933 he "topped" the market 11 times, and in 1934 16 times. Three carloads of the 1934 consignments were then sent to the world's fair. In 1935 he "topped" the market 19 times and in 1936 18 times.

This exceedingly remarkable record is only attained through the most careful thought and study of needs of the cattle and attention to detail, as well as the practice of the knowledge so gained.

The death loss is exceedingly low. One year not a single animal died.

The feed is all mixed on the place and includes alfalfa hay, corn, barley, dried sugar beet pulp mixed with molasses, and cottonseed cake.

FARM EQUIPMENT

There is a grain elevator on the farm with a capacity of 25,000 bushels, of which about 15,000 bushels are in underground bins, and all feed grinding is done on the place. The grain chutes in the elevator are so arranged that the different feeds can be mixed and ground by one man who has only to pull the different levers to get the kind and quantity of each grain desired for the mix. Both the elevator and potato cellar were constructed according to Mr. Atteberry's own designs. Mr. Atteberry personally supervises the mixing of all feeds. The feeding of the cattle is done exactly at the same hour each day and Mr. Atteberry is not absent from the place at feeding time more than five or six times during the year.

Waste and inefficiency are not tolerated on this place. The farm machinery and equipment are always kept in repair and ready to go, and every part must perform its particular function economically. As an example of this, a tower and windmill erected in 1910, which has been in operation continuously and still is in first-class condition, is supplying the water for 500 to 800 head of stock per year.

Elevated runways are constructed so that feeds hauled to the place in large trucks can be unloaded into the farm wagons by placing the wagon on the lower elevation and transferring the feed to the wagon by simply opening the endgate of the supply truck and letting the required amount of feed flow out by gravity.

Visitors are welcome but they are not permitted to do anything that might startle or in any manner disturb the cattle. Everything possible is done to make the cattle contented and comfortable; their likes and dislikes in the matter of feeds are of prime importance, as the beef from these pens go to the finest

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Reclamation Organization Activities and Project Visitors

R. F. Walter, chief engineer, spent 2 days on the Boulder Canyon project early in May. During the month Mr. Walter also visited the Rio Grande project and Caballo Dam, and the Provo River project, Utah. At Salt Lake City, Mr. Walter discussed with the officials in charge matters pertaining to the Deer Creek division of the Provo River project.

E. O. Larson, engineer, Provo River project, Utah, and J. R. Alexander, district counsel, Salt Lake City, spent some time in the Washington office during the month of June in connection with the Deer Creek division of the Provo River project.

B. E. Stoutemyer, district counsel at Portland, Oreg., conferred with J. S. Moore, superintendent of the Yakima project, at Yakima early in May, and in company with the superintendent visited the Kittitas division. While on the Yakima project Mr. Stoutemyer also conferred with C. E. Crownover, construction engineer, Roza Division, and the attorney for the Terrace Heights irrigation district, relative to the inclusion of the district in the Roza division.

Engineers Carl Vetter, of the Denver office, and W. F. Resch, of the Rio Grande project, were called to Washington to attend meetings on June 14–15 of the Interdivisional Committee on Density Currents, of the National Research Council. The purpose of the meeting was to give attention to the question of density currents of silt-laden water in lakes and reservoirs.

Prof. Guolamo Ippolito, department of hydraulic engineering, University of Naples, Naples, Italy, called at the Boulder Canyon project office on May 19.

Prof. Toshimasa Matsuda, of the Agricultural College at Tsu, Japan, visited the Ogden River project, Utah, the latter part of May and inspected the work in progress at Pine View Dam.

T. S. Martin, former Yuma project master mechanic, and now traveling inspector for the Denver office, visited the Yuma project during the month of May.

Alfonso de la O, engineer of the hydrographic division, Irrigation Department of Mexico, Mexico City, accompanied by A. G. Basich, engineer of water inspection service, and Manuel Valle, chief of operations, Irrigation Commission, both of Mexicali, B. C., called at the Yuma project office in May with reference to methods of desilting and silt prevention.

J. Stuart McMaster, assistant district counsel at Salt Lake City, Utah, spent several days the latter part of May on the Humboldt project, Nevada, in consideration of local legal matters.

H. H. Plumb, electrical engineer in the Denver office, spent 12 days on the Yakima project in May supervising repairs to the transformer at the Prosser power plant. He later spent several days on the Kittitas division in an adjustment of the automatic control mechanism on the Yakima River tunnel.

F. E. Fyfe, president of the board of directors of the Sunnyside Valley irrigation district, resigned from the board in May to become full-time field manager for the district, as a result of a recent ruling by the attorney general of the State of Washingon. Mr. Fyfe was succeeded as president by E. N. Roady. The new member of the board is E. R. Wells, of Prosser.

Edward K. Buker, a senior laborer caretaker in the E. C. W. organization on the Yuma project, Arizona, passed away June 6. With frequent interruptions he was employed on the Yuma project, in various capacities, from January 1907 until January 1931. In May 1936 he was employed as caretaker for E. C. W. Camp BR–13, which position he held at the time of his death. Mr. Buker was 56 years of age and is survived by his widow and six children.

John Mayhall, associate engineer, and Hanford Thayer, junior engineer, Columbia Basin project, Washington, who have been employed by this bureau to assist with work in connection with fish control, under the supervision of the Director of Fisheries, State of Washington, are being transferred, effective July 1, to the State of Washington's Department of Fisheries to continue the protection of the interests of the salmon industry and related work at the Grand Coulee Dam.

The following appointments were authorized by the Secretary of the Interior during the month of May:

Washington office:

- Mrs. Felicia Peninger, senior stenographer, Stenographic Section, vice Miss Katherine T. Ashlin, transferred to the Boulder Canyon project. (Mrs. Peninger was formerly with the P. W. A., Washington.)

Denver office:

- Floyd E. Essman, under clerk.
- James Alva Stites, junior engineer, vice Carl J. Scheve.
- Willard M. Patterson, junior clerk, by transfer from the United States Engineer's Office, War Department, Fort Peck, Mont.
- Robert G. Hooson, assistant clerk, by transfer from the United States Engineer's Office, War Department, Portland, Oreg.

Boulder Canyon project:

- Harry E. Fitch, ranger, succeeding Orren P. Senter, transferred to the National Parks Service.

Moon Lake project:

- Miss Inez Lambert, under clerk, vice Miss Emma Stevenson. (Miss Lambert was formerly employed by the Resettlement Administration, Logan, Utah.)

Casper-Alcova project:

- Gordon L. Sutherland, assistant clerk, vice George Dellapicola, resigned.

Klamath project:

- Francis J. O'Connor, junior engineer.

Parker Dam project:

- Lionel G. McCray. inspector.

The following transfers were authorized by the Secretary of the Interior during the month of May:

From Denver:

- Milton E. Trenam, assistant engineer, to associate engineer, Vallecito Dam, Pine River project.
- Oliver H. Millikan, junior engineer, to Taylor Park, Gunnison, Colo.
- William E. Green, assistant engineer, to associate engineer, Moon Lake Dam, Moon Lake project.
- William E. Wheeler, inspector, to the Casper-Alcova project.
- Clifford J. Okeson, junior geologist, Rio Grande Joint Investigations, to Boise Investigations, Boise, Idaho.
- David O. Ehrenburg, junior engineer, to the Taylor Park, Uncompahgre project, Gunnison, Colo.

To Denver:

John K. Ayers, junior engineer, from Central Valley project (Antioch) Calif.

Fred O. Sihler, engineering draftsman, from Washington.

From Pine View Dam, Ogden River project:

Victor H. Pinneo, Paul Whipple, and John F. Ball, diamond drillers, and Ellis J. Peterson, inspector, to Alcova Dam, Casper-Alcova project.

From Humboldt project:

Edgar O. Baird, inspector, to Truckee Storage.

From Kennett Dam, Central Valley project, Redding, Calif.:

Audrey Walker, inspector, to Salt River project, Phoenix, Ariz.

From Conchas Surveys, Tucumcari, New Mexico:

Leslie H. Abernathy, diamond drill foreman, to the Altus project surveys near Altus, Okla.

Reinstatements:

Adolph O. Dreyer, senior engineering draftsman, Rio Grande project.

Lewis H. Hawkins, assistant clerk, Vallecito Dam, Pine River project.

Frank E. Goehring, junior engineer, Denver office.

Miss Catherine C. Keltsch, clerk in the Denver office, was recently married to Mr. Johnson and her name has been so changed in the Bureau's records. Congratulations.

Resignations—Washington:

Jacob S. Matlack, junior clerk, to return to private business in Pennsylvania.

Denver:

Milton T. Cole, associate engineer, to accept offer of employment in Chicago, Ill.

Philip J. Edwards, junior engineer, to accept employment with the Westinghouse Electric Co., at Sharon, Pa.

Lewis A. Hurst, junior engineer, to accept employment at Phoenix, Ariz.

Alfred L. Fay, associate engineer, to accept offer of employment by the Aluminum Company of America, Pittsburgh, Pa.

Lawrence F. Koontz, assistant engineer, to accept employment with the Tennessee Valley Authority.

Casper F. Hegner, junior engineer, to accept position with an architectural firm in Denver, Colo.

Cyril J. Miller, junior engineer. Will go to Dubuque, Iowa.

Robert R. Williams, junior engineer, to accept employment with the Illinois State Highway Department, Springfield, Ill.

Rex L. Fossnight, junior engineer, to accept employment with the Erie Concrete & Steel Supply Co., Erie, Pa.

Alvord D. Noble, associate engineer, will be employed by the Aluminum Co. of America, Pittsburgh, Pa.

Emmett E. Rowell, assistant clerk, to go with business firm in Denver, Colo.

Edwards W. Barnum, assistant engineer, to go with the Anaconda Copper Mining Co., Butte, Mont.

Dolph Campbell, junior engineer, to accept appointment with the National Resources Committee at Santa Fe, N. Mex.

Boulder Canyon project:

Mrs. Marion Bunker, assistant clerk.

Salt River project:

Alva R. Tanner, inspector.

All-American Canal project:

Ernest Davis, engineering draftsman, to return to Los Angeles, Calif.

Ogden River:

Paul S. Bieler, engineering draftsman.

Colorado River Investigations:

Waltgen B. Smith, assistant reclamation economist.

Caballo Dam, Rio Grande:

Mrs. Mary V. Secher, junior clerk, as her family is moving to Sacramento, Calif.

Erosion and Flood Control

(Continued from p. 165)

located 1¼ miles above the Apache Dam as a silt retainer, are both of rock masonry construction, and built by the same method as the Apache Dam. Both these supplemental dams are on solid rock.

The Box Canyon Dam was designed in the Denver office of the Bureau of Reclamation. The Apache Dam was designed on the project and reviewed by the engineers of the Denver office. Both sites were visited and inspected by representatives of the chief engineer, Bureau of Reclamation, both before and during construction.

DURING the month of May five 4–H and F. F. A. weed clubs, with 40 to 50 members, were organized on the Klamath project.

Progress of Investigations

(Continued from p. 159)

traversing the area through what is known as Mountain Sheep Pass. The canal line is 22.6 miles long and involves difficult sidehill construction.

(*b*) *Salt Lake City Aqueduct.*—The report on the aqueduct investigations was completed.

Colorado River Basin investigations—(*a*) *Montezuma Valley, Colo.*—Classification of a small area north and west of Cortez, Colo., was resumed, and completed during the month. This area totals 11½ square miles or 7,360 acres.

(*b*) *Piceance Creek, Colo.*—On May 24 an irrigated area and classification survey of Piceance Creek was begun, and at the close of the month 1,280 acres had been completed.

(*c*) *San Miguel area, Colorado.*—The classification of undeveloped lands on the proposed San Miguel, Lilylands, and Nucla projects, in the vicinity of Norwood, Nucla, and Naturita, Colo., was continued throughout the month.

(*d*) *Huntington River, Utah.*—Mapping was begun on the irrigated lands along the Huntington River in the vicinity of Huntington, Utah.

Successful Cattle Feeder, North Platte Project

(Continued from p. 166)

markets and most exacting consumers in the world.

A FULL-TIME JOB

Mr. Atteberry devotes his entire time and attention to this enterprise with the result that it has paid out and is entirely free from debt. This also includes the construction obligation assessed by the Bureau of Reclamation.

Mr. Atteberry has never taken advantage of the moratoriums of construction payments granted by the Bureau of Reclamation. He has made every payment as it became due and has paid his last and final installment, so his indebtedness to the Bureau of Reclamation is paid in full.

MANY MEN have been reemployed in the mining industry on properties in the vicinity of the Humboldt project, Nevada. It is expected that a number of worthwhile camps will be developed in the near future.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

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Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, C. C. C. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz	R. B. Williams	Constr. engr	J C Thrailkill	R. J. Coffey	Los Angeles, Calif
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont
Boise	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg
Boulder Dam and power plant [1]	Boulder City, Nev	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex
Alamogordo Dam	Fort Sumner, N. Mex	Wilfred W. Baker	Constr engr		do	Do.
Casper Alcova	Casper, Wyo	H. W. Bashore	do	C. M. Voyen	W. J Burke	Billings, Mont
Central Valley	Sacramento, Calif	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif
Colorado River in Texas	Austin, Tex	H. P. Bunger	do	William F. Sha	H. J S DeVries	El Paso, Tex
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E Stoutemyer	Portland, Oreg
Frenchtown	Frenchtown, Mont				W. J. Burke	Billings, Mont.
Gila	Yuma, Ariz	R. B. Williams	Constr. engr		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Superintendent	Emil T Ficenec	J R Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev	L. J. Foster	Constr. engr	George B. Snow	do	Do.
Klamath	Klamath Falls, Oreg	B E. Hayden	Superintendent	W. I. Tingley	B E Stoutemyer	Portland Oreg
Milk River	Malta, Mont	H. H. Johnson	do	E. E. Chahot	W. J. Burke	Billings, Mont
Fresno Dam	Havre, Mont	H. V. Hubbell	Constr. engr	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Acting supt	G. C Patterson	B. E Stoutemyer	Portland, Oreg
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr	Francis J. Farrell	J. R Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J Burke	Billings, Mont
Ogden River	Ogden, Utah	J R. Iakisch	Constr engr	H W Johnson	J. R. Alexander	Salt Lake City Utah.
Orland	Orland, Calif	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R J. Newell	Constr. engr	Robert B. Smith	B E. Stoutemyer	Portland, Oreg
Parker Dam	Parker Dam, Calif	E. A. Moritz	do	George W. Lyle	R J. Coffey	Los Angeles, Calif
Pine River (Vallecito Dam)	Bayfield, Colo	Charles A. Burns	do		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	Superintendent	H. H Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex	S. F. Crecelius	Constr. engr		do	Do
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings Mont
Salt River	Phoenix, Ariz	E. C. Koppen	Constr. engr	Edgar A. Peek	R J. Coffey	Los Angeles, Calif
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
Shoshone	Powell, Wyo	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont
Heart Mountain	Cody, Wyo	Walter F. Kemp	Constr. engr	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont	A. W. Walker	Superintendent		do	Do.
Truckee River Storage	Reno, Nev	L. J. Foster	Constr. engr	George B. Snow	J R. Alexander	Salt Lake City, Utah
Umatilla (McKay Dam)	Pendleton, Oreg	C. L. Tice	Reservoir supt		B. E. Stoutemyer	Portland, Oreg
Uncompahgre: Taylor Park	Gunnison, Colo	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo	C B Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage [3]	Ashton, Idaho	H. A Parker	do	Emmanuel V Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash	J S Moore	do	Philo M. Wheeler	do	Do.
Roza division	do	Charles E. Crownover	Constr engr	Alex S. Harker	do	Do
Yuma	Yuma, Ariz	R C. E. Weher	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting [3] Island Park and Grassy Lake Dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg	A. J. Ritter	President	F. A. Phillips	Keating
Bitter Root	Bitter Root irrigation district	Hamilton, Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton
Boise	Board of Control	Boise, Idaho	Wm. H Tuller	Project manager	F J. Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L M Watson	Caldwell
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn, Colo	C. W. Tharp	do	C. J McCormich	Grand Jctn
Huntley	Huntley irrigation district	Ballantine, Mont	E E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A	Wellsville Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr.	President	Dorothy Eyers	Do
Lower Yellowstone	Board of Control	Sidney, Mont	Axel Persson	Manager	O. B Patterson	Sidney.
Milk River: Chinook division [1]	Alfalfa Valley irrigation district	Chinook, Mont	A L. Benton	President	R. H. Clarkson	Chinook
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A Ballard	Manager	O. W. Paul	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding
Newlands	Truckee-Carson irrigation district	Fallon, Nev	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	do	Flora K. Schroeder	Mitchell
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O. Fleenor	Superintendent	C G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo	Bert L. Adams	do	Mary E. Harrach	Torrington
Northport division	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J. Thompson	Bridgeport
Okanogan	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	do	D. D Harris	Layton
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	H J. Lawson	Superintendent	F. C Henshaw	Phoenix
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo	M. P. McLaughlin	Irri. superintendent	Geo. W. Atkins	Powell.
Frannie division	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Superintendent	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn	Payson, Utah	S. W. Grotegut	Manager	E. G. Breeze	Payson.
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	E J. Gregory	do	E. J. Gregory	Fort Shaw
Greenfields division	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H P. Wangen	Fairfield
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D. Martin	Hermiston
West division	West Extension irrigation district	Irrigon, Oreg	A. C. Houghton	do	A C. Houghton	Irrigon
Uncompahgre	Uncompahgre Valley W U. A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose.
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash	V. W. Russell	Manager	G. L. Sterling	Ellensburg.

[1] Operated by 5 irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash	F A Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo	Mills E Bunger	Engineer.
Gallatin Valley	Bozeman, Mont	R. R. Robertson	Engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Do.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo	Frank C. Merriell	Do
Black Hills	Rapid City, S. Dak	R E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	Denver, Colo	A N Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do.
Conchas	Tucumcari, N. Mex	J. A Keimig	Associate Engineer
Grande Ronde	La Grande, Oreg	C. C. Fisher	Engineer.

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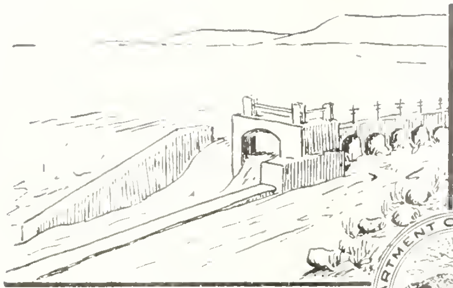
MORMON FLAT DAM, SALT RIVER PROJECT, ARIZONA
GENERAL VIEW OF DAM. LOOKING UPSTREAM

THE RECLAMATION ERA



THE RECLAMATION ERA

PRICE 75 CENTS A YEAR

HAROLD L. ICKES
SECRETARY OF THE INTERIOR

JOHN C. PAGE
COMMISSIONER, BUREAU OF RECLAMATION

VOL. 27, NO. 8

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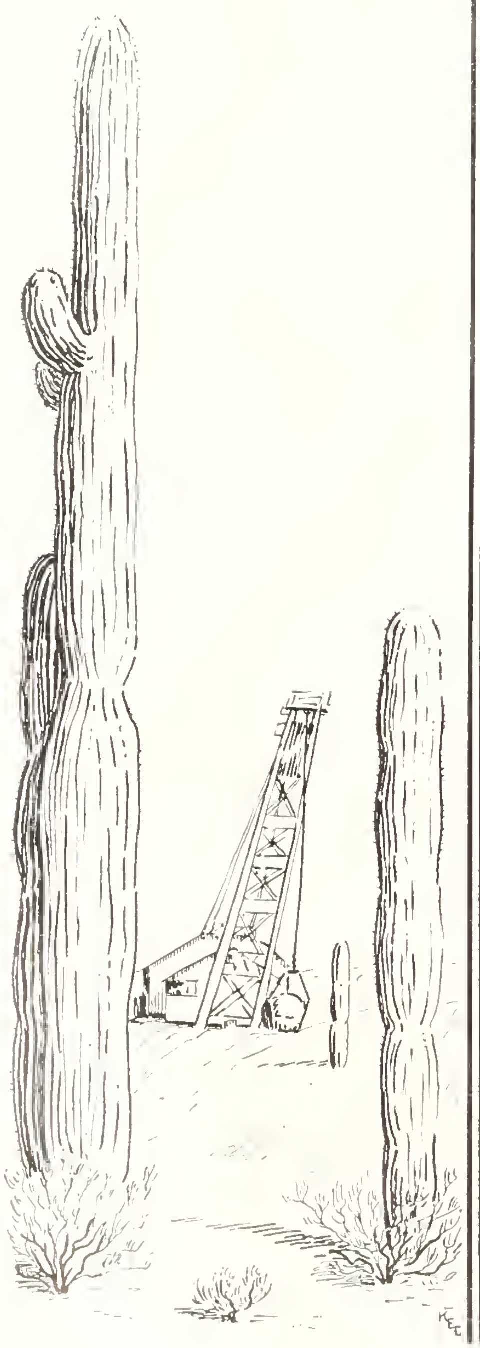


CONTENTS

The Program and Objectives of the Reclamation Bureau

By B. E. Stoutemyer, District Counsel, Portland, Oregon [1]

IRRIGATION by English speaking people on this continent began with the Mormons shortly after their arrival in Utah. The first irrigation project consisted of a plow furrow to divert water from City Creek near the site of the present city of Salt Lake to produce food to save the followers of Brigham Young from threatened starvation.

The easiest, simplest, and cheapest projects were built first and as these opportunities were exhausted, irrigation structures progressed from the first plow furrow ditch to the greatest engineering structures ever conceived by man—such as Boulder Dam. This 726-foot structure now controls the entire run-off of the Colorado River. Flood waters that once threatened the Imperial Valley with destruction, are now a highly useful and urgently needed source of water supply for the entire Southwest. Boulder Dam not only gives relief from flood damage but provides a supplemental municipal water supply for Los Angeles, as well as a dozen smaller communities in southern California, which have been combined in the Metropolitan Water District. This area, incidentally, contains about 45 percent of the entire assessed valuation of the State of California. Boulder Dam also affords a reliable water supply for irrigation and cheap electrical power for industrial development.

Four times in the brief history of its development, the Reclamation Bureau has constructed the highest dam in the world, first in 1910, the Shoshone Dam in Wyoming, 328 feet in height; second in 1915, the Arrowrock Dam in Idaho, 353 feet high; again in 1933, with the Owyhee Dam in Oregon, 417 feet high; and finally, Boulder Dam, which, rising to a maximum height of 726 feet above foundation, is not likely to be exceeded in our generation. While Boulder Dam will probably not be exceeded in height, the total amount of concrete in the 550-foot Grand Coulee Dam, now under construction in the State of Washington, is more than two and one-half times that involved in construction of the Boulder Dam.

[1] Address given at the Fisheries Meeting, Portland, May 7, 1937.

POWER DEVELOPMENT

The production of electrical power is mentioned last in the acts of Congress authorizing such structures as Boulder Dam, Grand Coulee Dam, and the Kennett Dam in California, with their multiple and varied benefits. However, it is interesting to note that revenues from the sale of power on the Boulder Canyon project will pay the entire cost of the project with 4 percent interest, amortize the principal in 50 years, and leave a substantial surplus after providing heavy contributions to both Arizona and Nevada in lieu of the taxes which might have been collected had the project been constructed by private enterprise.

ELECTRIC POWER, INCIDENTAL FEATURE OF PROJECTS

In the acts of Congress authorizing these major water conservation projects, production of electrical power is referred to as incidental to other purposes of the project and for the purpose of helping to pay the cost of the project. Compared with the necessity of preventing the destruction of such communities as the Imperial Valley by floods, the requirement for adequate municipal water supply for more than 2,000,000 persons in Los Angeles County, and the need for irrigation water in the arid sections where irrigation is the very lifeblood of the entire community, electric power is correctly rated as of minor importance. This is true because electric power could be produced by steam or obtained from other surces, while in most instances the reclamation project is the only means of providing the indispensable water supply necessary to the very existence of the community. It is well to keep in mind that on the major projects to which I have referred, electric power is the packhorse that carries the load and pays all or a large part of the cost of the project. Without power development none of these projects would be feasible.

CONSTRUCTION OF PROJECTS IMPROVES NAVIGATION

One of the benefits derived from construction of the Boulder Canyon and Columbia Basin projects is the improvement of navigation, usually mentioned first in the acts of Congress authorizing such projects. This is of minor value in the case of Boulder Dam but of importance in the case of Grand Coulee Dam, which will provide a navigable lake 150 miles long extending to the Canadian border. Its major function in aid of navigation is accomplished by the storage of flood waters, 5,000,000 acre-feet of usable storage capacity being provided. Such storage will take the peaks off of many floods, and by releasing the stored water during low water stages, it is estimated that the low water elevation of the Columbia River will be increased about 4 feet in the stretch section between Grand Coulee Dam and the mouth of the Snake River, and about 2 feet below the mouth of Snake River.

In this connection, we must keep in mind that the complete development of

(Cut along this line)

the Columbia River for the many purposes for which it is adapted, including navigation, will require the construction of some 8 or 10 large dams, of which Bonneville Dam is located farthest downstream and Grand Coulee Dam is farthest upstream. The Grand Coulee Dam has been referred to in opinions recently written by the Circuit Court of Appeals of the Ninth Circuit, as the key structure in the development of this second largest stream in the United States. One reason why Grand Coulee Dam is so considered is that by river regulation, storing floods, and releasing stored water during low water stage, this reservoir will double the firm power which can be produced at each of the proposed dams between the mouth of the Snake and the Grand Coulee. It will also add 50 percent to the firm power which can be produced at each of the dams below the mouth of the Snake, thus adding greatly to the feasibility of all the other dams as self-liquidating projects.

WATER, MOST VALUABLE RESOURCE IN WEST

Water is by far the most valuable resource in that third of the United States which lies west of the one-hundredth meridian. Its conservation and wise use, therefore, creates the greatest benefit and imposes the gravest responsibility in this arid region. Even in the Willamette Valley, which is not considered a part of the arid region but which has almost no rainfall in July and August, it is estimated that crop production could be increased more than 100 percent by storage and use of the available water supply for irrigation.

Those who are not familiar with the water supply problems of the western third of the United States have assumed there will be no end to irrigation. They do not realize that all available water is insufficient to provide adequate supplies for more than about 3 out of each 100 acres. When the national Reclamation Act was passed in 1902 upon the recommendation of that very constructive and far-seeing former President, Theodore Roosevelt, the progress of irrigation had reached a point where practically all of the simple and cheap projects had been built, either by individual efforts of early settlers or by private enterprise under private corporations and irrigation districts. It was then generally recognized that if the development of the arid West was to continue, the Federal Government must lend a helping hand in coordinating and helping to finance the necessary works for the conservation of the scanty and highly precious water supply of the arid regions.

In his message to Congress recommending the Reclamation Act, Theodore Roosevelt stated:

"It is as right for the national Government to make the streams and rivers of the arid region useful by engineering works for water storage as to make useful the rivers and harbors of the humid region by engineering works of another kind. The storing of the floods in reservoirs at the headwaters of our rivers is but an enlargement of our present policy of river control, under which levees are built on the lower reaches of the same streams.

"The reclamation and settlement of the arid lands will enrich every portion of our country, just as the settlement of the Ohio and Mississippi Valleys brought prosperity to the Atlantic States. The increased demand for manufactured articles will stimulate industrial production, while wider home markets and the trade of Asia will consume the larger food supplies and effectually prevent western competition with eastern agriculture. Indeed, the products of our irrigation will be consumed chiefly in upbuilding the local centers of mining and other industries, which would not otherwise come into existence at all. Our people as a whole will profit, for successful homemaking is but another name for the upbuilding of the Nation."

CAREY ACT PROJECTS

A few years prior to the passage of the national Reclamation Act, the Carey Act was passed which provided for irrigation construction with private capital under state control. About 98 percent of the Carey Act projects constructed during the Carey Act era of irrigation development proved disastrous to the investors who purchased the securities of these companies and furnished the money for the construction of the works. Of all the Carey Act projects with which I am familiar, only one, the original Twin Falls Company, proved profitable to the investors who furnished the money for construction purposes, or even avoided a serious loss. Although these enterprises in most cases proved disastrous to the investors, and in many instances also to the settlers on the land, they did result in the construction of extensive canal systems and the settlement of many thousands of families on the lands.

During the 10 or 15 years preceding the beginning of construction of Boulder Dam, the major activity of the Reclamation Bureau consisted in salvaging projects begun and originally constructed under private enterprise and in saving the homes of many thousands of settlers under the Carey Act projects and other private enterprises who would otherwise have been obliged to move out for lack of adequate water supply for irrigation purposes. This was particularly true in southern Idaho, where the Carey Act companies had their greatest boom, although the same thing has occurred to some extent throughout most of the Western States. Fortunately, many of these enterprises were located on sizable streams, where by the construction of more reservoirs and the storage of flood waters and winter flow, the water supply could be made adequate. Even on the most successful of the Carey Act projects, the original Twin Falls Company found it advisable to contract for a supplemental water supply from the American Falls Reservoir, which was constructed by the Reclamation Bureau.

The lack of adequate water supply on many of these projects was due in part to the fact that the promoters were in many cases over-optimistic and failed to


OWYHEE DAM SPILLWAY, OWYHEE PROJECT, OREGON-IDAHO.
SPRAY RISING WITH UPDRAFT OF AIR.

consider the water measurement records which were then available and which if consulted would have furnished ample warning that there would be no adequate water supply for the proposed project. But in many cases there was also another factor involved for which the promoters could not be very much blamed—on many of the streams in the arid region the available runoff during the past 10 years has been only about one-half as much as the available run-off of preceding decades on which the water measurement records were based at the time the projects were started. Whether the past 10 years is the normal condition as to water supply and the preceding decades an abnormally wet period, or whether the past 10-year period is merely a low-water cycle which again will be followed by comparatively high-water conditions is an interesting problem on which there is some difference of opinion.

During the past 15 years the work of the Reclamation Bureau in rescuing projects initiated under private enterprise and in saving the homes of settlers already on the lands on such projects has increased to such an extent that the total acreage of land on projects started under private enterprise, which is now receiving a highly essential part of its water supply from Government constructed reservoirs, is larger than the entire acreage for which Government projects were originally constructed.

CONSERVING FISH IN RECLAMATION STREAMS

As this is a fishery meeting you will no doubt be interested in knowing something of the plans of the Reclamation Bureau to conserve the fish resources of our western streams or at least to avoid doing any serious damage to such resources.

Most of the streams on which reclamation projects have been built, like the muddy Colorado, are streams in which the fish are of little value. It has been said that the Colorado River water is "too thick to drink and too thin to plow." Under natural conditions there are no game fish or commercial fish in such waters, but by providing a clear-water lake, the largest artificial lake in the world, an opportunity is given for the development of useful game fish such as bass and trout. This opportunity is being utilized by the planting of valuable fish in Lake Mead above Boulder Dam.

In the Columbia River commercial fishing has always been an important industry, although not so important in the Grand Coulee section. It is estimated that only about 10 percent of the salmon which enter the mouth of the Columbia ever go up as far as the Grand Coulee Dam. Most of them spawn in the tributary streams which come into the river below Grand Coulee.

Since no feasible plan has ever been developed for a fish ladder which will permit fish to go over a dam as high as Grand Coulee, it is proposed to trap salmon going upstream at some convenient location below Grand Coulee, probably at the Rock Island Dam. The spawn from these captured fish will be hatched in extensive hatcheries to be provided for this purpose and raised in rearing ponds until they reach such size as may be considered most suitable to be returned to the river. Where salmon spawn under natural conditions certainly as many as 95 percent and probably 99 percent of the salmon eggs and young salmon are destroyed by natural enemies or adverse natural conditions before the fish reach the fingerling size available from artificial hatcheries and rearing pools. But if the eggs and young fish are handled in modern hatcheries and rearing ponds, almost 100 percent of them are saved and reach a suitable size for release into the river. Therefore, if all of the salmon that ascend the Columbia River past Rock Island Dam are trapped, and all of the spawn hatched and held in the rearing ponds, it may be assumed that the substitution of artifically hatched fish will not only preserve that part of the salmon run which would naturally reach Grand Coulee, but may result in doubling or trebling the number of young salmon available for the downstream migration from that part of the river above Rock Island.

In this connection, I have been interested in the difference of opinion which seems to exist between wildlife enthusiasts who tell us that the canalization of the Columbia River by the Bonneville Dam and other dams to be constructed upstream will destroy the salmon run in spite of fish ladders at Bonneville and other similar structures.

Those who have had long professional experience in fishery matters, particularly relating to the salmon industry, such as Mr. Brennan of the fishery department of the State of Washington, assure us that the lugubrious predictions of destruction of the fish industry by Bonneville and other dams on the Columbia have no merit. They believe, as we do, that our proposed expenditure for fish propagation in connection with the Grand Coulee Dam will be very useful and effective in preserving and perhaps in increasing the annual salmon run in the Columbia River.

Charles A. Peavey Dies

Charles A. Peavey, a former employee of the Bureau of Reclamation, died on June 4, 1937, at Franklinville, N. Y., of pneumonia. He had been ill only about 1 week. Mr. Peavey was born in Richburg, N. Y., August 13, 1875. He was first employed by the Bureau on October 6, 1906, as a bookkeeper on the Shoshone project and was transferred to the Huntley project the following year. He later served as Chief Clerk on the Shoshone and Sun River projects and was transferred to the Rio Grande project at El Paso, Tex., as Chief Clerk effective March 1, 1918. He continued in this assignment until December 31, 1924, when he resigned to engage in private business. Mr. Peavey is survived by his widow, Mrs. Mabel F. Peavey, whose address is Franklinville, N. Y.

THE farm morale on the Belle Fourche project has improved materially with the change in weather conditions, and a more hopeful attitude is apparent in connection with production since much of the grain will need no irrigation and the water supply will be better for the late crops.

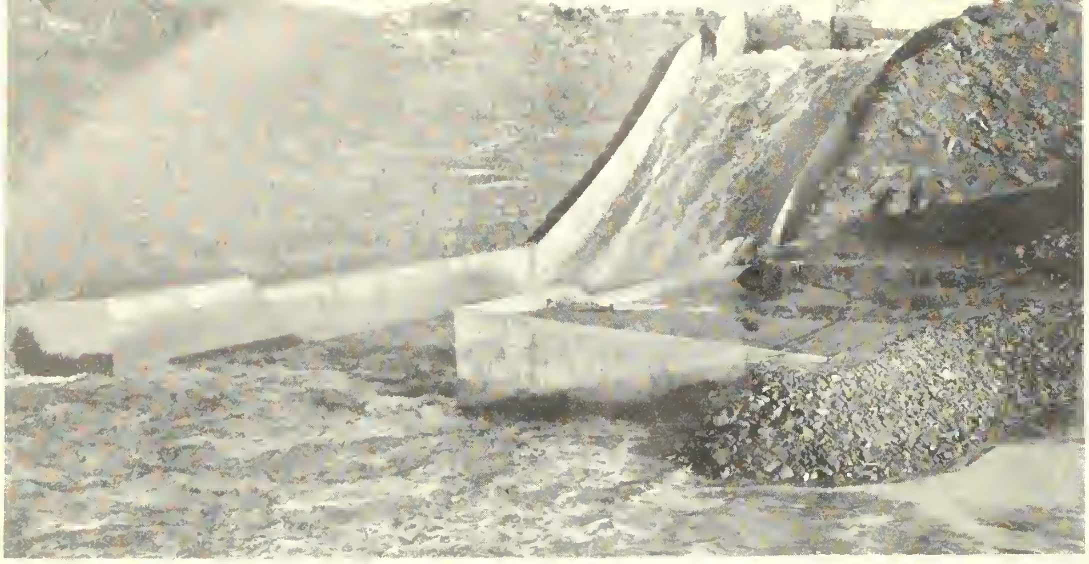
Imperial Valley Produces Mildew Resistant Cantaloupe

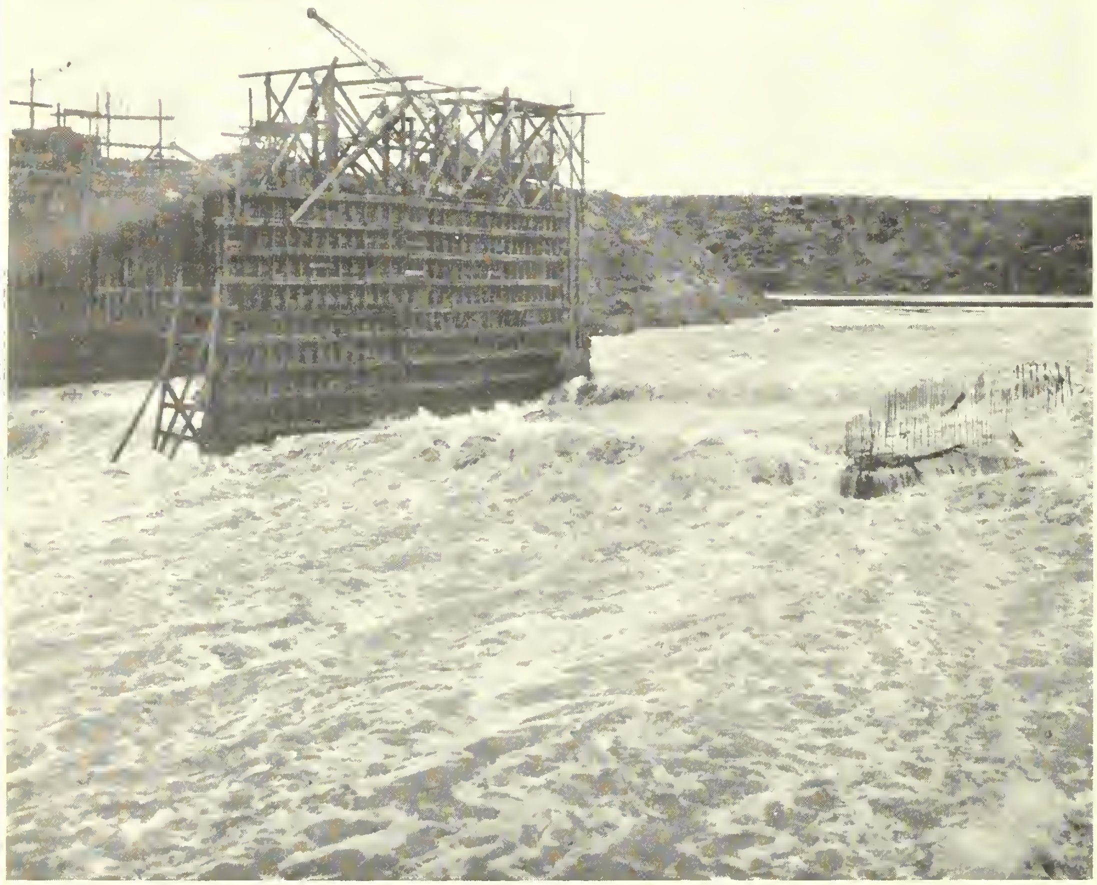
A new cantaloupe—Mildew Resistant Cantaloupe No. 45—is again putting the Imperial Valley in first place in the production of cantaloupes. This new variety, resistant to powdery mildew, has been developed by the United States Department of Agriculture and the California Agricultural Experiment Station.

In producing this resistant variety, cantaloupes from India, resistant to mildew but of no commercial value, were crossed with Hale Best, a desirable California variety. Many generations of selective breeding resulted in the production of no. 45. The new cantaloupe is similar to Hale Best in superior taste and shipping qualities, but matures a little later. It is slightly oblong and uniform in shape and size. The seed cavity is small and the fruit holds firm even when shipped long distances. The flesh is firm and sweet. Its color is "salmon" although a little lighter than other commercial varieties.—*Utah Farmer.*

Second Drowning in Elephant Butte Reservoir

The second drowning occurred in Elephant Butte Reservoir on the night of July 18, when Mrs. F. W. Warren, wife of an El Paso (Tex.) dentist, dived into the lake from a motorboat in the deepest part of the lake where there is about 150 feet of water. Mrs. Warren, who was 28 years of age, is survived by her husband, Dr. F. Wardell Warren, and two children, Nancy Marie, 8, and F. Wardwell III, 5





UPPER: SPILLWAY AND TAILRACE LOOKING NORTHWEST. RESERVOIR 4,258 FEET.

LOWER: LOOKING UP SPILLWAY FROM EAST SIDE.

Alamogordo Dam Stems Record Pecos Flood

Alamogordo Dam, being constructed by the Bureau of Reclamation to provide supplemental water storage for the Carlsbad reclamation project, New Mexico, performed an unexpected and valuable service to the Pecos Valley during the recent flood, although at the time it was but 83 percent complete.

This dam, estimated to cost on completion $1,833,500 cut the peak of the flood and saved perhaps $1,000,000 in damages to the area below Fort Sumner. It did this by storing 100,000 acre-feet of water, sufficient to cover 100,000 acres a foot deep, and discharging through its almost completed spillway and outlet works only 14,400 cubic feet of water per second into the channel downstream at the peak of the flood. This was sufficient to swell the lethargic Pecos, but not enough to cause major damage. At the peak, however, 75,000 cubic feet of water per second were being poured into the Alamogordo Reservoir, with the Pecos at flood stage and the Pintado, Alamogordo, and Juan de Dios arroyas contributing major flows.

Despite the severe test, although the dam was incomplete, no major damage was done to the structure. The spillway suffered virtually no damage. The damage at the dam, estimated at $10,000, was confined almost entirely to destruction of construction roads and bridges and similar work not a part of the dam itself.

The flood began rising at 6 a. m., May 28. The flow varied with no major flood arriving at the reservoir until about 7 o'clock in the morning of June 2, when it reached 35,500 second-feet. An hour later the flow was 56,000 second-feet and by noon the peak had arrived with 75,000 cubic feet per second being poured into the reservoir. The reservoir, which was nearly empty at the start of the flood and had not been used, rose about 20 feet in 24 hours, and began spilling at 3 p. m., June 3.

The flood resulted from a heavy rain which was measured at 7.16 inches at Alamogordo Dam and must have approached this figure all over the watershed.

There was a short period the night of June 3 when Bureau of Reclamation officials at the dam were fearful that it would be necessary to let the rising reservoir spill through the dike section of the dam. Arrangements were made to warn residents of De Baca County to flee their homes and an airplane was sent by Governor Tingley to assist in evacuating the people in the Pecos Valley between Fort Sumner and Carlsbad if that should become necessary.

The dam withstood the tide, however, and the emergency was averted.

W. W. Baker, Construction Engineer for the Bureau of Reclamation, said the dam undoubtedly saved major damage at Fort Sumner, Roswell, and Carlsbad. He said:

"The peak flood would have practically washed away the entire Fort Sumner Valley and undoubtedly would have caused serious damage to Roswell, already under water from the Hondo and Pecos Rivers. It was known that McMillan Dam at Carlsbad was in a weakened condition from lower floods and the strain of this peak might have been too great for it."

Liability for Damages

Liability of Canal Owners as Insurers Irrespective of Negligence and of Directors of Irrigation Districts

EXCERPT from a decision rendered June 8, 1937, by the Supreme Court of Oregon, in the case of *Patterson* v. *Horsefly Irrigation District*, holding that directors of an irrigation district are not personally liable for damages; that canal owners are not liable as insurers "irrespective of negligence"; and that canal owners and operators are not liable for damages irrespective of negligence:

"The jury was further instructed as follows:

"No. V

" 'I instruct you that if you find that the defendant district improperly constructed the ditches mentioned in the complaint and that during the time which has elapsed since such construction it has taken no steps or action properly to reconstruct or remake or relay said ditches, *in such event the district would be negligent*, and if it continued to neglect said ditches, if the ditches were originally improperly constructed and made, if you find from the evidence that such is the fact, and you further find that plaintiffs have been damaged as alleged in their complaint *by the acts of said defendant district*, then you may bring in a verdict against the *defendants* for such amount of damages as the evidence proves has been suffered by the plaintiffs on their said premises and crops or either of them.'

* * * *

"No. VII

" 'I instruct you where a person by artificial means causes water to percolate through the soil to the injury of his neighbor (he) does so at his peril and is legally responsible therefor irrespective of negligence. Therefore, if you find that the plaintiffs' lands or crops were damaged, injured or destroyed by defendants, *or any of them* in the respects mentioned in plaintiffs' complaint, I instruct you that defendants, *and each of them* would be liable even though you might find that they were not guilty of conscious negligence.'

"Instruction V, above quoted, makes the defendant directors personally liable solely because of the negligence of the district. Instruction VII eliminates entirely the question of negligence so far as it concerns all the defendants. It is difficult to conceive the full import of this latter instruction. It refers to 'conscious negligence', yet the jury is left in doubt as to what that may mean.

"The jury is further instructed that if the plaintiffs' lands or crops were damaged, injured or destroyed by the defendants, or any of them, without any qualification as to how such destruction or injury may have been brought about, then all the defendants are liable. The effect of this entire instruction would seem to be that it makes the district and all its directors insurers against damage of any and every nature resulting from construction, operation, or maintenance of the Horsefly irrigation system.

"In *Longmire* v. *Yelm Irrigation District*, 114 Wash. 619 (195 P. 1014), the court said:

" 'We have already held that one who impounds water is bound to exercise such reasonable care and caution in the construction, maintenance, and operation of his works as a reasonably careful and prudent person, acquainted with the conditions, would exercise under like circumstances, but that he is not an insurer. *Anderson* v. *Rucker Bros.*, 107 Wash. 595, 183 P. 70, 186 P. 293, 8 A. L. R. 544. The law seems to be well settled in this country that ditch owners are bound to exercise only ordinary care in the construction and maintenance of their ditches (15 R. C. L. 488), and that an owner of land lying below an irrigation ditch can not recover for damages caused by seepage without showing that the ditch was negligently constructed or operated (*North Sterling Irrigation District* v. *Dickman*, 59 Colo. 169, 149 P. 97, Ann. Cas. 1916 D., 973; *Nahl.* v. *Alta Irrigation District*, 23 Cal. App. 333, 137 P. 1080).

" 'Respondents rely upon the case of *Howell* v. *Big Horn Basin Colonization Co.*, 14 Wyo. 14, 81 P. 785, 1 L. R. A. (N. S.) 596, but a careful reading of that case convinces us that it announces no other or different doctrine.'

"In accord with the decision in the Washington case last above cited is 3 Kinney on Irrigation and Water Rights (2d Ed.), 672, which amplifies it as follows:

" 'But the strict rule of liability, as laid down in the cases of dams and reservoirs, and discussed in the previous sections, is not usually applied to ditches and canals, where the water is under no, or comparatively little, pressure. The carrying of water through ditches and canals is not a dangerous or menacing undertaking, and by the exercise of ordinary or reasonable care, it can be rendered comparatively harmless. And, therefore, even the English courts, which hold the owners of reservoirs to the strict liability for the damages caused by water escaping from such reservoirs without proof of negligence, do not hold the same rule of liability in the cases of water escaping from ditches and canals, upon the ground that it is not so liable to escape except in case of actual negligence, and, if the water does escape it is liable to do little injury, as compared with that when the escape is from a reservoir. Therefore, in applying the rule of negligence or ordinary care to ditch and canal cases, the courts hold that it is the duty of the owners thereof to exercise in their construction, maintenance, or operation, only such a degree of care, which ordinarily prudent men would exercise under like circumstances were the *risk* their own. And, that, in order to recover damages for injuries from the

escape of the water from such works, the plaintiff must allege and prove negligence upon the part of the owners, or at least the want of ordinary care. In other words the owners of an irrigation canal or ditch are not liable as insurer, for injuries sustained to adjoining property by seepage, leakage, or overflow from the canal or ditch, but are only liable for such injuries in case of actual negligence.'

"To the same effect, see *Spurrier* v. *Mitchell Irrigation District*, 119 Neb. 401 (229 N. W. 273, 74 A. L. R. 884); *North Sterling Irrigation District* v. *Dickman*, 59 Colo. 169 (149 P. 997); *Salt River Valley Water Users' Ass'n* v. *Stewart*, 44 Ariz. 119 (34 P. (2d) 400); *Mackay* v. *Breeze*, 72 Utah 305 (269 P. 1026); *Howell* v. *Big Horn Basin Colonization Co.*, 14 Wyo. 14 (81 P. 785); *Burt* v. *Farmers' Co-operative Irrigation Co.*, 30 Idaho 752 (168 P. 1078); *Fleming* v. *Lockwood*, 36 Mont. 384 (92 P. 962, 14 L. R. A. (N. S.) 628); 1 Wiel on Water Rights in the Western States, para. 461.

"The instruction last above quoted removed from the consideration of the jury the question of negligence on the part of the defendants, and, under the pleadings and evidence in the case, was erroneous. We have not overlooked *Mallett* v. *Taylor*, 78 Or. 208 (152 P. 873), relied upon by the respondents. That was a suit in equity to restrain the defendant from negligently permitting water used by him to escape by overflow and percolation onto plaintiff's land, and the court found that the defendant was guilty of negligence. *Taylor* v. *Farmers' Irrigation Co.*, 82 Or. 701 (162 P. 973), recognizes the rule that negligence is an essential element to be proved in order to recover damages due to seepage and leakage.

"The plaintiffs attempt to justify the giving of instruction VII by their theory that the damage done to their land amounted to expropriation thereof by the defendants, which theory, as we have already stated, is inapplicable to the facts in this case. *Morrison* v. *Clackamas County*, 141 Or. 564 (18 P. (2d) 814); *Beck* v. *Lane County*, 141 Or. 580 (18 P. (2d) 594); and the other Oregon cases cited and relied upon by the plaintiffs to the effect that the acts of the defendants amounted to expropriation of the plaintiffs' land, involve entirely different sets of facts from that in the case at bar and are not here controlling.

"The defendants predicate error on the refusal of the court to give the following instruction:

"The court instructs you that certain officers of the defendant Horsefly irrigation district have been joined as parties defendant in this action. In this connection the court instructs you that the facts that Schmor and Davis were directors of the district and that Mrs. Eyers was secretary of the district, would not make them personally liable for any damage arising from the operation of the ditches, even though you find that such operations were negligently done, unless you further find that the said defendants acted wilfully and maliciously, or that they acted on their own account and not as officers of the irrigation district.'

"In our opinion, the court should have instructed the jury as requested by defendants: *Verheyen* v. *Dewey*, 27 Idaho 1 (146 P. 1116); *Osborne* v. *Imperial Irrigation District*, 8 Cal. App. (2d) 622 (47 P. (2d) 798).

"With reference to the legal status of irrigation districts, we find the following in *Twohy Bros. Co.* v. *Ochoco Irrigation District*, 106 Or. 1 (210 P. 873, 216 P. 189):

" 'An irrigation district organized under the Irrigation District Law of this State is a municipal corporation, its property public property, and its officers public officers, elected by the legal voters of the irrigation district, with duties and powers fixed and limited by the law of their creation. Such a district 'is created for a public purpose and it rests in the discretion of the legislature when to create it and with what powers to endow it.' '

"The evidence fails to show that the damages suffered by the plaintiffs were due to the misfeasance or negligence of the defendant directors. They are not liable for nonfeasance: *Corliss* v. *Van Duzer*, 132 Or. 265 (285 P. 253). According to rule 1 of the district, the canals and works of that defendant are under the exclusive control of its manager and his associates, and their negligence, if any, cannot be charged to the directors."

Address of J. L. Savage on Boulder Dam

The lecture delivered by J. L. Savage Chief Designing Engineer of the Bureau of Reclamation at the meeting of the Institute of Civil Engineers in London on April 15, has been published in the June issue of the journal of the society (no. 7, pp. 161–180).

The article, which is profusely illustrated with engravings, cuts, and large folded drawings, gives a description of the project and the various features including the penstocks and outlet tunnels, spillways, dam proper, power plant, turbines, and electrical equipment.

The construction is described, including the plant and equipment used, the cofferdams built to divert the river, and the concrete mixing and handling plants.

A description is given of the unusual problems requiring special investigation in connection with the design of the immense structure, including the analyses of stresses and the use of models in checking the computations.

LABOR conditions on the Sanpete project, Utah, are much improved by reason of the several small building and relief projects which absorbed a large percentage of the unemployed.

COLUMBIA BASIN PROJECT, WASHINGTON. GRAND COULEE DAM

WEST END OF DAM LOOKING DOWNSTREAM. WEST MIX IN LEFT FOREGROUND, ENGINEER'S TOWN IN LEFT BACKGROUND AND PORTION OF MASON CITY IN RIGHT BACKGROUND.

Bills introduced in the first session of the Seventy-fifth Congress of interest to the Bureau of Reclamation

INSTALLMENT NO. 1[1]

No.	Title	Author	Date introduced	Action
S. 47 (see also H. R. 2512 H. R. 5997 H. R. 5998).	To authorize an appropriation for the construction of small reservoirs under the Federal reclamation laws.	Mr. O'Mahoney	Jan 6, 1937	Reported from Committee on Irrigation and Reclamation April 22, 1937. Bill recommitted to same committee June 14, 1937.
S. 48 (see also H. R. 2511)	To authorize an appropriation for investigations under the Federal reclamation laws.	do	do	Passed by Senate April 9, 1937. Reported from House committee on Irrigation and Reclamation April 26, 1937.
S. 103 (see also S. 106; H. R. 8, H. R. 3590, H. R. 3876, H. R. 4220, H. R. 5362, H. R. 7562).	To create the Farm Tenant Home Purchase Corporation, to promote the purchase of farms and homes by farm tenants, and for other purposes.	Mr. Connally	do	Referred to Committee on Agriculture and Forestry.
S. 106 (see references under S. 103).	To establish the Farmers' Home Corporation, to encourage and promote the ownership of farm homes and to make the possession of such homes more secure, to provide for the general welfare of the United States, to provide additional credit facilities for agricultural development, to create a fiscal agent for the United States, and for other purposes.	Mr. Bankhead	do	Senate passed H. R. 7562 on July 2, 1937 but substituted text of S. 106.
S. 109	To provide for the designing, making, preparing, construction, erection, placing, and maintaining of additions to and upon the Boulder Dam, on the Colorado River, between the States of Arizona and Nevada, for the architectural beautification of said dam and for memorial purposes.	Mr. Pittman	do	Referred to Committee on Irrigation and Reclamation.
S. 183	Granting the consent of Congress to the States of Montana, North Dakota, South Dakota, and Wyoming to negotiate and enter into a compact or agreement for division of the waters of the Little Missouri River.	Mr. Murray	do	Do.
S. 198 (see also H. R. 6091)	To provide for a preliminary examination and survey to determine the feasibility and cost of diverting the surplus waters of the Green River, Wyo., to the Bear River, for the purpose of irrigating the lands in the Bear River Basin.	Mr. King	do	Do.
S. 203	To provide for the protection of watersheds in and adjacent to national forests.	do	do	Referred to Committee on Agriculture and Forestry.
S. 206 (see also H. R. 201, H. R. 1983).	To provide a preliminary examination and survey of the Snake River and tributaries in the States of Idaho, Washington, and Oregon with a view to control of flood waters.	Mr. Borah	do	Approved by the President, Mar. 5, 1937. Public, No. 14.
S. 207	Relative to Members of Congress acting as attorneys in matters where the United States has an interest.	do	do	Referred to Committee on Judiciary.
S. 250 (see also S. 714; H. R. 1590, H. R. 2700, H. R. 3408, H. R. 4658.	Extending the classified executive civil service of the United States.	Mr. Logan	do	Referred to Committee on Civil Service.
S. 272 (see also H. R. 290; S. 1686).	To establish uniform requirements affecting Government contracts, and for other purposes.	do	do	Referred to Committee on Judiciary.
S. 324 (see also H. R. 3425)	Providing payment to employees, Bureau of Reclamation, for mileage traveled in privately owned automobiles.	Mr. Hatch	do	Referred to Committee on Irrigation and Reclamation.
S. 330	To provide for the conveyance to entrymen under the land laws of the United States of the rights to the gas, oil, and oil shale in the lands patented to them.	do	do	Referred to Committee on Public Lands and Surveys.
S. 369	To allow credit to homestead settlers and entry men for certain military service.	Mr. Nye		Passed Senate June 7, 1937. Referred to House Committee on Public Lands June 15, 1937.
S. 405 (see also H. R. 3557)	For the relief of the Coast Fir & Cedar Products Co., Inc.	Mr. Steiwer	do	Referred to Committee on Claims.
S. 413 (see also S. 1501; H. R. 108, H. R. 1499, H. R. 5853).	To extend the time for the completion of the investigation of reclamation projects authorized by the act of Apr. 14, 1936.	Messrs. Borah and Hatch.	do	Passed by Senate Mar. 15, 1937. Referred to House Committee on Irrigation and Reclamation Mar. 16, 1937.
S. 433 (see also H. R. 111)	To provide for a survey of the Cabinet Gorge on the Clark Fork of the Columbia River.	Mr. Pope	Jan. 8, 1937	Referred to Committee on Commerce. Referred to Committee on Irrigation and Reclamation Mar. 31, 1937.
S. 445	For the relief of owners of lots in the unflooded portion of the old townsite at American Falls, Idaho.	do	do	Referred to Committee on Public Lands.
S. 457	To amend sections 1 and 6 of the Civil Service Retirement Act, approved May 29, 1930, as amended.	Mr. Neely	do	Referred to Committee on Civil Service.
S. 462	To authorize any Government department to exchange used parts of certain types of equipment for new or reconditioned parts of the same equipment.			Approved by the President Apr. 15 1937. Public, No. 32
S. 531	To provide compensation for disability or death resulting from injury to employees of contractors on public buildings and public works.	Mr. Wheeler	do	Referred to Committee on Education and Labor.
S. 534	Granting the consent of Congress to the States of Montana and Wyoming to negotiate and enter into a compact or agreement for division of the waters of the Yellowstone River.	do	do	Presented to President for signature July 27, 1937.
S. 539 (see also S. 1337)	To amend section 15 of the act entitled "An act to stop injury to the public grazing lands by preventing overgrazing and soil deterioration; to stabilize the livestock industry dependent upon the public range; and for other purposes", approved June 28, 1934 (48 Stat. 1269).	do	do	Referred to Committee on Public Lands and Surveys.
S. 607	To authorize improvement of navigation facilities on the Columbia River, and for other purposes.	Mr. McNary	Jan. 11, 1937	Passed by Senate July 22, 1937. Reported from Committee on Interstate and Foreign Commerce July 28, 1937.
S. 615 (see also H. R. 295, H. R. 1624; S. 730, H. R. 4479; S. 1687; H. R. 5533, H. R. 6103, H. R. 6564, H. R. 7321).	To amend an act entitled "An act for the retirement of employees in the classified civil service, and for other purposes", approved May 22, 1920.	Mr. Gibson	do	Referred to Committee on Civil Service.
S. 706	For the relief of the Lake Chelan reclamation district	Mr. Schwellenbach	Jan. 12, 1937	Referred to Committee on Claims.
S. 708 (see also H. R. 7610)	Granting an increase of compensation to William B. Lancaster.	Mr. King	do	Do.
S. 714 (see references under S. 250).	Relating to the eligibility of certain persons for admission to the civil service.	Mr. Moore	do	Passed by Senate June 29, 1937. Referred to House Committee on Civil Service June 30, 1937.
S. 729	To establish a branch of the Department of the Interior in one of the public-land States, to transfer to such branch certain bureaus and offices of the Department of the Interior, and for other purposes.	Mr. King	Jan. 14, 1937	Referred to Committee on Public Lands and Surveys.
S. 730 (see references under S. 615).	Amending the Civil Service Retirement Act	Mr. Copeland	do	Referred to Committee on Civil Service.

[1] This is the first of a series of listings which will be carried in future issues of the Reclamation Era.

No.	Title	Author	Date introduced	Action
S. 741 (see also H. R. 273, H. R. 2903, H. R. 3682, H. R. 6556; S. 2582; H. R. 7740).	To amend the act of Mar. 4, 1923, entitled "An act to provide for the classification of civilian positions within the District of Columbia and within the field services, and amendments thereto."	Mr. McCarran	Jan. 14, 1937	Referred to Committee on Civil Service. On Feb. 15, 1937, Senator McCarran submitted an amendment in the nature of a substitute which was referred to Committee on Civil Service.
S. 903	To stabilize communities, farm income, forest industries, employment, taxable forest wealth, and to assure a continuous and ample supply of forest products; and to secure the benefits of forests in regulation of water supply and stream flow, prevention of soil erosion, and amelioration of climate.	Mr. McNary	Jan. 19, 1937	Referred to Committee on Agriculture and Forestry.
S. 976 (see also H. R. 5415)	Relating to labor preferences in connection with certain public-works projects.	Mr. Pittman	Jan. 22, 1937	Passed by Senate Mar. 15, 1937. Referred to House Committee on Ways and Means Mar. 16, 1937.
S. 983 (see also H. R. 258, H. R. 2727, H. R. 4193, H. R. 7237).	To create a United States Civil Service Board of Appeals	Mr. Capper	do	Referred to Committee on Civil Service.
S. 1076 (see also H. R. 5969)	To provide for the payment of certain indebtedness on lands acquired by the United States.	Mr. Lundeen	do	Referred to Committee on Public Lands and Surveys.
S. 1195 (see also H. R. 1603, H. R. 3423).	To provide for the preferred employment of American citizens by the Government of the United States.	Mr. Reynolds	Jan. 29, 1937	Referred to Committee on Expenditures in Executive Departments.
S. 1275 (see also H. R. 3889)	Relating to the authority of the Reconstruction Finance Corporation to make rehabilitation loans for the repair of damages caused by floods or other catastrophes, and for other purposes.	Mr. Bulkley	Feb. 1, 1937	Referred to Committee on Banking and Currency.
S. 1304 (see also H. R. 4410)	To provide for an adequate survey and classification of the soil resources of the United States; to provide for a system of soil conservation; to provide for an ever-normal granary; to provide for a system of commodity loans; to provide for disposal of excess production of agricultural products; to provide for the regulation of imports of farm products, and for other purposes.	Mr. Gillette	Feb. 2, 1937	Referred to Committee on Agriculture and Forestry.
S. 1337 (see also S. 539)	To amend the Taylor Grazing Act	Mr. McCarran	do	Referred to Committee on Public Lands and Surveys.
S. 1344	Providing for relief in cases of desert-land applications or entries of lands within Verde River irrigation and power district, Arizona.	Mr. Ashurst	Feb. 3, 1937	Do.
S. 1410	To amend the Inland Waterways Corporation Act, approved June 3, 1924, as amended, authorizing the Secretary of War to extend the services and operations of the Inland Waterways Corporation to the Columbia River.	Mr. McNary	Feb. 8, 1937	Referred to Committee on Commerce.
S. 1440 (see also H. R. 4603).	To provide for the control of the floodwaters of the rivers of the United States, for the improvement of navigability of such rivers, for reforestation and conservation of natural resources, and for other purposes.	Messrs. Barkley and Bulkley.	Feb. 10, 1937	Do.
S. 1501 (see references under S. 413).	To create a commission and to extend further relief to water users on United States reclamation projects and on Indian irrigation projects.	Mr. Borah	Feb. 15, 1937	Referred to Committee on Irrigation and Reclamation.
S. 1561 (see also H. R. 1637, S. 1623, S. 1624).	To amend the Emergency Farm Mortgage Act of 1933, as amended and for other purposes.	Mr. Connally	Feb. 17, 1937	Referred to Committee on Banking and Currency.
S. 1570	Granting the consent of Congress to compacts or agreements between the States of Minnesota, South Dakota, and North Dakota with respect to the Red River of the North.	Mt. Frazier	do	Passed by Senate Mar. 19, 1937. Referred to House Committee on Flood Control Mar. 22, 1937.
S. 1623 (see references under S. 1561).	To amend section 36 of the Emergency Farm Mortgage Act of 1933, as amended, to provide an interest rate of 3 percent per annum on loans to agricultural improvement districts.	Mr. Robinson	Feb. 19, 1937	Referred to Committee on Agriculture and Forestry.
S. 1624 (see references under S. 1561).	To amend section 36 of the Emergency Farm Mortgage Act of 1933, as amended.	do	do	Referred to Committee on Banking and Currency.
S. 1686 (see also H. R. 290, S. 272).	To establish uniform requirements affecting Government contracts, and for other purposes.	Mr. Logan	Feb. 24, 1937	Referred to Committee on Judiciary.
S. 1744 (see also H. R. 2267)	To provide more adequate protection to workmen and laborers on projects, buildings, constructions, and improvements, wherever situated, belonging to the United States of America.	Mr. Sheppard	Mar. 2, 1937	Referred to Committee on Education and Labor.
S. 1742	For the conservation of rainfall in the United States	do	do	Referred to Committee on Agriculture and Forestry.
S. 1755 (see also H. R. 5248)	To provide for the further improvement of the Columbia and Snake Rivers in Oregon and Idaho.	Messrs. McNary, Steiwer and Pope.	do	Referred to Committee on Commerce.
S. 1775	To authorize a survey to determine the feasibility of irrigation projects, flood control, and power plants in the Marias River watershed in the State of Montana.	Mr. Wheeler	Mar. 3, 1937	Referred to Committee on Irrigation and Reclamation.
S. 1785	To provide for cooperation between agencies of the Government in the purchase and sale of agricultural lands, and for other purposes.	Mr. Ellender	Mar. 8, 1937	Referred to Committee on Agriculture and Forestry.
S. 1792	To define the exterior boundary of the Uintah and Ouray Indian Reservation in the State of Utah, and for other purposes.	Mr. King	do	Referred to Committee on Indian Affairs.
S. 1800 (see also H. R. 5693)	Providing for the cancelation of certain charges against the Klamath Drainage District, of Klamath County, Oregon, and charging such unpaid balance to the unentered public lands within the district.	Mr. McNary	Mar. 9, 1937	Referred to Committee on Irrigation and Reclamation.
S. 1815 (see also H. R. 5586)	To provide for the construction of four bridges across the United States Reclamation "A" Canal in Klamath Falls, Oregon.	do	Mar. 11, 1937	Referred to Committee on Irrigation and Reclamation. Mr. McNary submitted an amendment on Mar. 25, 1937.
S. 1830 (see also H. R. 4269, H. Res. 161).	To provide for a useful and comprehensive system for the impounding, storing, conserving, and making use of the unappropriated waters falling or emanating within the United States, and for other purposes.	Mr. Thomas	do	Referred to Committee on Commerce.
S. 1889	Authorizing the Secretary of the Interior to convey all right, title, and interest of the United States in certain lands to the State of New Mexico, and for other purposes.	Messrs. Hatch and Chavez.	Mar. 15, 1937	Referred to Committee on Public Lands and Surveys.
S. 1899	To amend an act approved June 16, 1934, entitled "An act to provide relief to Government contractors whose costs of performance were increased as a result of compliance with the act approved June 16, 1933, and for other purposes.	Mr. LaFollette	Mar. 17, 1937	Referred to Committee on Education and Labor.
S. 1935 (see also H. R. 5635)	For relief of disbursing officers	Mr. Bailey	Mar. 19, 1937	Passed by Senate May 3, 1937. Referred to House Committe on Expenditures in the Executive Departments. May 4, 1937.
S. 1945	To authorize the Secretary of the Interior to grant concessions on reservoir sites and other lands in connection with Federal Indian irrigation projects wholly or partly Indian, and to lease the lands in such reserves for agricultural, grazing, and other purposes.			Passed by the Senate Apr. 7, 1937. Reported from House Committee on Indian Affairs July 8, 1937.

No.	Title	Author	Date introduced	Action
S. 2086 (see also H. R. 6146, H. R. 7680.)	To authorize appropriations for the construction of the Arch Hurley Conservancy District in New Mexico.	Messrs. Hatch and Chavez.	Apr. 5, 1937	Presented to President for signature July 23, 1937.
S. 2092 (see also H. R. 4948, H. R. 6151, H. R. 6387, H. R. 6973, H. R. 7010, H. R. 7642, S. Doc. 21).	To authorize the completion, maintenance, and operation of the Bonneville project for navigation, and for other purposes.	Messrs. Bone, McNary, Schwellenbach and Steiwer.	do	Recommitted to Committee on Commerce July 27, 1937.
S. 2102 (see also H. R. 4481, H. R. 5046, H. R. 6180, H. R. 6551, H. Doc. 196).	To establish a Civilian Conservation Corps, and for other purposes.	Mr. Black	Apr. 7, 1937	Reported from Committee on Education and Labor on May 12, 1937.
S. 2158	To authorize a preliminary examination and survey of the Gila River, in Arizona, from Gillespie Dam downstream to a point near Wellton, with a view to the control of its floods, and for other purposes.	Mr. Hayden	Apr. 15, 1937	Referred to Committee on Commerce.
S. 2165	To amend the act entitled "An act to provide conditions for the purchase of supplies and the making of contracts by the United States and for other purposes."	Mr. Walsh	do	Referred to Committee on Education and Labor.
S. 2172 (see also H. R. 6319)	To prevent speculation in lands in the Columbia Basin prospectively irrigable by reason of the construction of the Grand Coulee Dam project and to aid actual settlers in securing such lands at the fair appraised value thereof as arid land, and for other purposes.	Messrs. Bone and Schwellenbach.	do	Approved by the President on May 27, 1937. Public, No. 117.
S. 2187	To authorize a preliminary examination and survey of the Little Colorado River and its tributaries upstream from the boundary of the Navajo Indian Reservation in Arizona, with a view to the control of its floods, and for other purposes.	Mr. Hayden	Apr. 19, 1937	Referred to Committee on Commerce.
S. 2188	To amend section 3 of the act of June 18, 1934 (48 Stat. 984–988), relating to Indian lands in Arizona.	do	do	Passed by Senate May 17, 1937. Passed by House July 19, 1937.
S. 2252	To authorize a refund to Louis Nelson and the administratrix of the estate of W. W. Custer of payments upon a judgment in favor of the United States for rentals on a lease in the Minidoka reclamation project.	Mr. Pope	Apr. 27, 1937	Referred to Committee on Claims.
S. 2309 (see also H. R. 209, H. R. 6771).	To amend the Subsistence Expense Act of 1926	Mr. McAdoo	Apr. 29, 1937	Referred to Committee on Appropriations.
S. 2341 (see also H. R. 4791, H. R. 5943, H. R. 7319, H. R. 7363).	To continue the Federal Emergency Administration of Public Works for 2 years, and for other purposes.	Mr. Clark	May 3, 1937	Do.
S. 2398	For the relief of Tim Kelly	Mr. Wheeler	May 11, 1937	Referred to Committee on Public Lands and Surveys.
S. 2428	Providing for the sale of land in Billings, Mont	Mr. Murray	May 13, 1937	Do.
S. 2480	To authorize a preliminary examination and survey of the Platte River in the vicinity of Schuyler, Nebr., with a view to the control of its floods, and for other purposes.	Mr. Norris	May 26, 1937	Referred to Committee on Commerce.
S. 2534	To authorize the purchase or condemnation of land and the removal thereto of the town of Marcus, Wash., which will be flooded by the Grand Coulee Dam project.	Mr. Bone	June 1, 1937	Do.
S. 2555 (see also H. R. 7365, H. R. 7392, H. R. 7863, H. Doc. 261).	To provide for the creation of conservation authorities, and for other purposes.	Mr. Norris	June 3, 1937	Referred to Committee on Agriculture and Forestry.
S. 2582 (see references under S. 741).	To amend the Classification Act of 1923, as amended	Mr McCarran	June 7, 1937	Referred to Committee on Civil Service.
S. 2583 (see aso H. R. 7513)	To provide for the acquisition of certain lands for and the addition thereof to the Tahoe National Forest, in the State of Nevada, and for other purposes.	do	do	Referred to Committee on Public Lands and Surveys.
S. 2584 (see also H. R. 6635)	To dispense with the necessity for insurance by the Government against loss or damage to valuables in shipment, and for other purposes	Mr. Lewis	do	Referred to Committee on Finance. Rereferred to Committee on Post Offices and Post Roads June 10,
S. 2614	Authorizing the Secretary of the Interior to patent certain tracts of land to the State of New Mexico and Cordy Bramlet.	Messrs. Hatch and Chavez.	do	Referred to Committee on Public Lands and Surveys.
S. 2670 (see also H. R. 7681)	To provide that the United States shall aid the States in wildlife restoration projects, and for other purposes.	Messrs. Pittman, Bailey, Clark, McNary, and White.	June 17, 1937	Reported from Special Committee on Conservation of Wildlife Resources July 6, 1937.
S. 2681 (see also S. Doc. 80)	To authorize the construction of the Grand Lake-Big Thompson transmountain water diversion project as a Federal reclamation project.	Mr. Adams	June 18, 1937	Passed by Senate June 24, 1937. Reported from House Committee on Irrigation and Reclamation July 6, 1937.
S. 2682 (see also H. R. 7578)	To authorize the Secretary of the Interior to issue patents to States under the provisions of sec. 8 of the act of June 28, 1934 (48 Stat. 1269), as amended by the act of June 26, 1936 (49 Stat. 1976), subject to prior leases issued under sec. 15 of the said act.	Mr. O'Mahoney	do	Reported from Committee on Public Lands and Surveys July 23, 1937.
S. 2688	To provide for preliminary examinations and surveys for run-off and waterflow retardation and soil-erosion prevention on the watersheds of the Rio Grande and Pecos River.	Mr. Chavez	June 21, 1937	Referred to Committee on Agriculture and Forestry.
S. 2700 (see also H. R. 67, H. J. Res. 81, S. Res. 69, S. Doc. 8).	To provide for reorganizing agencies of the Government, extending the classified civil service, establishing a General Auditing Office and a Department of Welfare, and for other purposes.	Mr. Robinson	June 23, 1937	Referred to Select Committee on Government Organization.
S. 2722	To authorize the construction of the San Juan-Chama Transmountain Diversion Reclamation project in New Mexico.	Messrs. Chavez and Hatch.	June 29, 1937	Referred to Committee on Irrigation and Reclamation.
S. Res. 65 (see also H. R. 7697).	Utilization of water resources of the arid and irrigable States.	Mr. Bankhead	Jan. 19, 1937	Passed by Senate, Feb. 25, 1937.
S. Res. 69 (see references under S. 2700).	Resolved, That the Vice President be, and he is hereby, authorized to appoint a select committee of 9 Members of the Senate to be known as the Select Committee on Government Organization, for the purpose of considering and reporting upon the subject matter contained in the message of the President of the United States of Jan. 12, 1937.	Mr. Neely	Jan. 27, 1937	Agreed to by Senate, Jan. 29, 1937.
S. J. Res. 12 (see also H. J. Res. 91, H. J. Res. 150).	To permit a compact or agreement between the States of Idaho and Wyoming respecting the disposition and apportionment of the waters of the Snake River and its tributaries, and for other purposes.	Mr. Borah	Jan. 6, 1937	Referred to Committee on Irrigation and Reclamation.
S. J. Res. 19	Providing for a study of reclamation projects	Mr. King	do	Do.
S. J. Res. 46	Requiring the approval of the Joint Committee on Printing for the inclusion of illustrations and color printing in Government annual reports.	Mr. Vandenberg	Jan. 15, 1937	Referred to Committee on Printing.
S. J. Res. 57 (see also H. J. Res. 175).	To authorize the submission to Congress of a comprehensive national plan for the prevention and control of floods of all the major rivers of the United States, and for other purposes.	Mrs. Caraway	Jan. 30, 1937	Passed by Senate on June 14, 1937.
S. J. Res. 71	Authorizing the printing of the transactions of the Third World Water Power Conference and of the Second Congress on Large Dams.	Mr. Norris	Feb. 8, 1937	Referred to Committee on Printing.

No.	Title	Author	Date introduced	Action
S. J. Res. 88 (see also H. J. Res. 314).	Providing for the participation of the United States in the world's fair to be held by the San Francisco Bay Exposition, Incorporated, in the city of San Francisco during the year 1939, and for other purposes.			Approved by the President July 9, 1937. Pub. Res. No. 52.
S. J. Res. 142 (see also H. J. Res. 338, H. J. Res. 345, H. Con. Res. 11).	Relative to the reduction or elimination of certain appropriations for the fiscal year 1938.	Mr. McKellar	May 6, 1937	Referred to Committee on Appropriations.
S. Doc. 8 (see references under S. 2700).	President's reorganization program			
S. Doc. 21 (see references under S. 2092).	Progress report of the committee on national power policy on the Bonneville project, situated on the Columbia River, Oreg.		Feb. 24, 1937	Referred to Committee on Commerce.
S. Doc. 80 (see also S. 2681).	Synopsis of report on the Colorado Big Thompson project		June 15, 1937	Printed copies now available.
H. R. 1	To create a Federal Industrial Commission to aid in the stabilization of employment in industry, agriculture, and commerce, and for other purposes.	Mr. Ludlow	Jan. 5, 1937	Referred to Committee on Labor.
H. R. 8 (see also H. R. 3590, H. R. 3876, H. R. 4220, H. R. 5362, H. R. 7562; S. 103, S. 106.)	To establish the Farmers' Home Corporation, to encourage and promote the ownership of farm homes and to make the possession of such homes more secure, to provide for the general welfare of the United States, to provide additional credit facilities for agricultural development, to create a fiscal agent for the United States, and for other purposes.	Mr. Jones	do	Referred to Committee on Agriculture.
H. R. 18	Declaring the policy of the United States with respect to irrigation and reclamation.	Mr. Culkin	do	Referred to Committee on Irrigation and Reclamation.
H. R. 41	Regulating the procedure for the award of Government contracts.	Mr. Mead	do	Referred to Committee on the Judiciary.
H. R. 67 (see also H. J. Res. 81, S. 2700, S. J. Res. 69, S. Doc. 8.)	To correlate certain governmental functions, and for other purposes.	Mr. Kleberg	do	Referred to Committee on Agriculture.
H. R. 92.	To authorize completion, maintenance, and operation of certain facilities for navigation on the Columbia River, and for other purposes.	Mr. Smith	do	Referred to Committee on Rivers and Harbors.
H. R. 108 (see also H. R. 1499, H. R. 5853; S. 413, S. 1501).	To extend further in certain cases the provisions of the act entitled "An act for the temporary relief of water users on irrigation projects constructed and operated under the reclamation law", approved Apr. 1, 1932, as extended.	Mr. White	do	Referred to Committee on Irrigation and Reclamation.
H. R. 114 (see also S. 433)	To provide for studies and plans for the development of a hydroelectric power project at Cabinet Gorge, on the Clark Fork of the Columbia River, and a reclamation project for the Rathdrum Prairie area, and for other purposes.	do	do	Passed by House and Senate. In conference.
H. R. 117.	To improve the navigability of the Columbia River and its tributaries; to provide for the flood control of the Columbia River and its tributaries; to provide for reforestation and the use of marginal lands in the Columbia River Basin; to provide for the agricultural and industrial development of the Columbia River Basin; to provide for the irrigation of lands in the Columbia River Basin; to provide for the development of electrical power in the Columbia River Basin; and for other purposes.	do	do	Referred to Committee on Irrigation and Reclamation.
H. R. 146	To require contractors on public-building projects to name their subcontractors, materialmen, and supply men, and for other purposes.	Mr. Griswold	do	Passed by House Mar. 24, 1937. Referred to Senate Committee on Public Buildings and Grounds Mar. 25, 1937.
H. R. 153	To appropriate the sum of $9,700,000 for the construction of Caddoa Reservoir, near Lamar, in the State of Colorado.	Mr. Martin	do	Referred to Committee on Appropriations.
H. R. 154	To cancel a specific class of rehabilitation loans against farmers and farm labor in the drought area as an obligation against the recipients and their property.	do	do	Referred to Committee on Agriculture.
H. R. 155 (see also H. R. 242, H. R. 5863, H. J. Res. 361, H. Doc. 234).	To provide relief and work relief until Jan. 1, 1938, on useful projects.	do	do	Referred to Committee on Appropriations.
H. R. 182	To provide for the control of flood waters of the Missouri Valley; to improve navigation of the Missouri River; to provide for irrigation of arid and semiarid lands, divert the flood waters of the Missouri River to receding or receded natural lake beds; to provide for the restoration and preservation of the water level of the Missouri Valley; to protect the fertility of the soil of the Missouri Valley; to provide for the generation, distribution, and sale of electricity; and for other purposes.	Mr. Burdick	do	Referred to Committee on Flood Control.
H. R. 201 (see also H. R. 1983, S. 206).	To provide a preliminary examination and survey of the Snake River and tributaries in the States of Idaho, Washington, and Oregon, with a view to control of flood waters.	Mr. White	do	Laid on the table as a similar Senate bill S. 206 was passed by the House Mar. 1, 1937.
H. R. 209 (see also H. R. 6771, S. 2309).	To restore in their original form sections 3 to 7, inclusive, of the Subsistence Expense Act of 1926, amended by Sections 207 and 208 of the Legislative Appropriation Act approved June 30, 1932.	Mr. Lamneck	do	Referred to Committee on Civil Service.
H. R. 218	For the cancelation of construction and water charges outstanding against the landowners in the Yellowstone irrigation project.	Mr. Lemke	do	Referred to Committee on Irrigation and Reclamation.
H. R. 242 (see references under (H. R. 155).	Making an appropriation to provide work relief	Mr. Martin	do	Referred to Committee on Appropriations.
H. R. 258 see also H. R. 2727, H. R. 4193, H. R. 7237, S. 983).	To create United States Civil Service Board of Appeals	Mrs. Jenckes	do	Referred to Committee on Civil Service.
H. R. 273 (see also H. R. 2903, H. R. 3682, H. R. 6556, H. R. 7740, S. 741, S. 2582).	To establish a minimum pay for Government employees	Mr. Dunn	do	Do.
H. R. 275	To provide for the control of flood waters in the Wisconsin Valley, to improve navigation on the Wisconsin River and its tributaries, to provide for the irrigation of arid and semiarid lands, and for other purposes.	Mr. O'Malley	do	Referred to Committee on Flood Control.
H. R. 282 (see also H. R. 5721).	To amend the Federal Register Act	Mr. Celler	do	Referred to Committee on Judiciary.
H. R. 290 (see also S. 272, S. 1686).	To establish uniform requirements affecting Government contracts, and for other purposes.	do	do	Do.
H. R. 295 (see also H. R. 1624, H. R. 4479, H. R. 5533, H. R. 6103, H. R. 6564, H. R. 7321, S. 615; S. 730; S. 1687.	Amending the Civil Service Retirement Act	do	do	Referred to Committee on Civil Service.
H. R. 1252	For the relief of Ellen Kline	Mr. Thomason	do	Passed by House July 21, 1937 Referred to Senate Committee on Claims July 22, 1937.

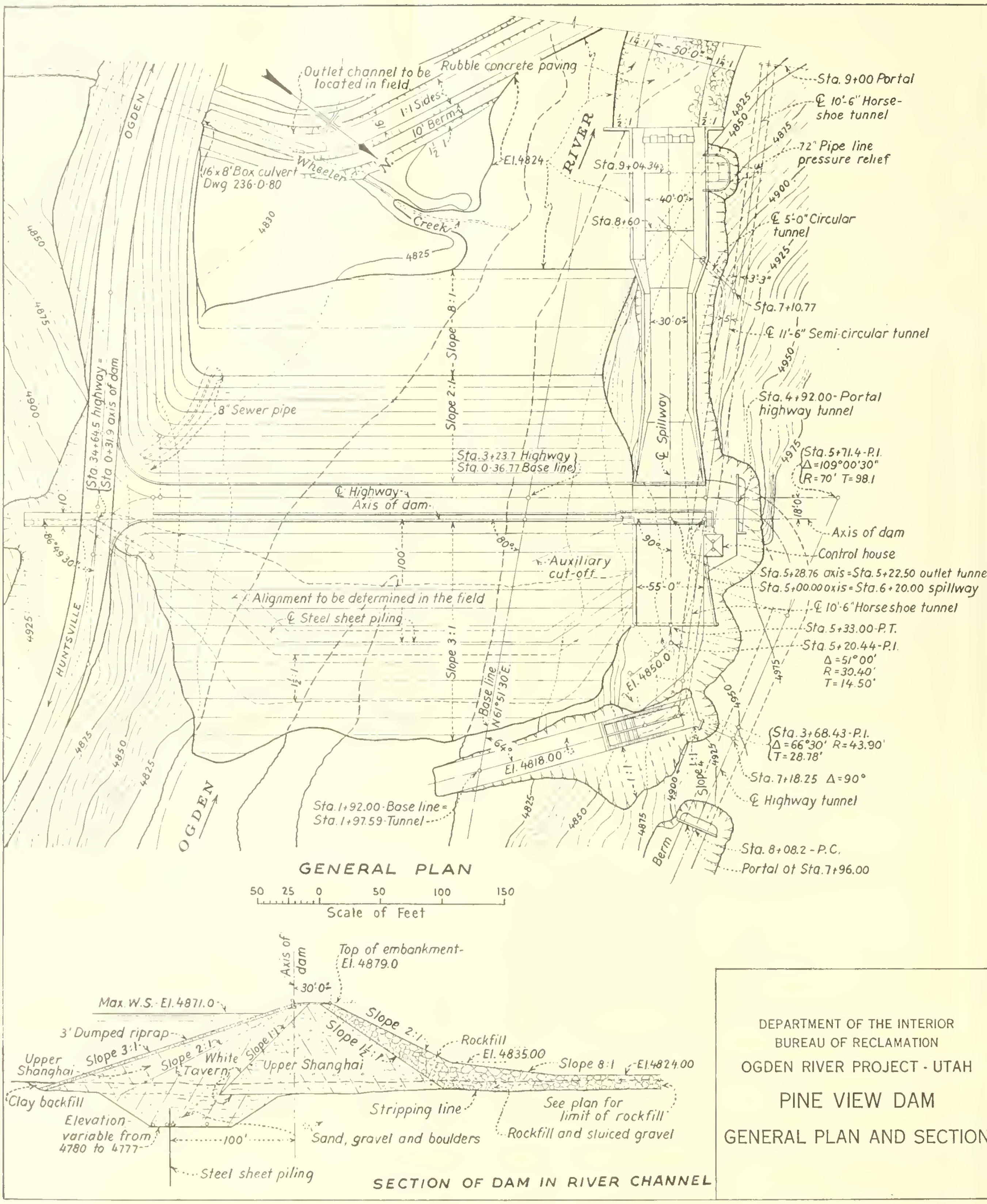
No.	Title	Author	Date introduced	Action
H. R. 1420	For the relief of Dewey Jack Krauss, a minor	Mr. Thomason	Jan. 5, 1937	Presented to President for signature July 26, 1937.
H. R. 1499 (see references under H. R. 108).	To create a commission and to extend further relief to water users on United States reclamation projects and on Indian irrigation projects.	Mr. Dempsey	do	Referred to Committee on Irrigation and Reclamation.
H. R. 1584	To regulate the level of water in certain reservoirs at the headwaters of the Mississippi River.	Mr. Knutson	do	Referred to Committee on Rivers and Harbors.
H. R. 1590 (see also H. R. 2700, H. R. 3408, H. R. 4658, S. 250, S. 714).	To permit classification of certain unclassified employees of the United States by noncompetitive examinations.	Mr. McCormack	do	Referred to Committee on Civil Service.
H. R. 1595	To provide for a 5-day week for Federal employees	do	do	Do.
H. R. 1602 (see also H. R. 2712, H. R. 5363).	To amend the act entitled "An act to amend an act entitled 'An act to provide compensation for employees of the United States suffering injuries while in the performance of their duties, and for other purposes', approved Sept. 7, 1916".	Mr. Cannon	do	Referred to Committee on Judiciary.
H. R. 1603 (see also H. R. 3423, S. 1195).	To amend the Emergency Relief Appropriation Act of 1935, limiting employment of labor and loans of Federal funds to citizens of the United States.	Mr. Curley	do	Referred to Committee on Appropriations.
H. R. 1624 (see references under H. R. 295).	Amending the Civil Service Retirement Act	Mr. Celler	do	Referred to Committee on Civil Service.
H. R. 1637 (see also S. 1561, S. 1623, S. 1624).	To amend section 36 of the Emergency Farm Mortgage Act of 1933, as amended, to provide an interest rate of 3 percent per annum on loans to agriculture improvement districts.	Mr. Fulmer	do	Referred to Committee on Agriculture.
H. R. 1671	To provide for the construction of works for flood control and improvement of navigation in the Congaree, Santee, and Cooper River Basins.	do	do	Referred to Committee on Flood Control.
H. R. 1968	For the protection of subcontractors, labor and material employed in public works.	Mr. Taylor	Jan. 6, 1937	Referred to Committee on Judiciary.
H. R. 1983 (see also H. R. 201, S. 206).	To provide a preliminary examination and survey of the Snake River and tributaries in the States of Idaho, Washington, and Oregon, with a view to control of flood waters.	Mr. Clark	do	Referred to Committee on Flood Control.
H. R. 2242 (see references under H. R. 295).	To provide retirement annuity to civil-service employees with 20 years' service involuntarily separated from the service.	Mr. Eaton	Jan. 8, 1937	Referred to Committee on Civil Service.
H. R. 2249	To prohibit the President of the United States, Civil Service Commission, or any branch thereof, from requiring as a condition precedent to the taking of an examination for a position in the classified civil service or as a condition precedent to an appointment in such service a photograph of applicants for such examinations.	Mr. Mitchell	do	Do.
H. R. 2267 (see also S. 1744)	For the protection of laborers and mechanics on public buildings or public works of the United States.	Mr. Wigglesworth	do	Referred to Committee on Labor.
H. R. 2286	Making appropriations for emergency relief in stricken agricultural areas.	Mr. Ferguson	do	Referred to Committee on Appropriations.
H. R. 2511 (see also S. 48)	To authorize an appropriation for investigations under the Federal reclamation laws.	Mr. Greever	Jan. 11, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 2512 (see also H. R. 5997, H. R. 5998; S. 47).	To authorize the appropriation for the construction of small reservoirs under the Federal reclamation laws.	do	do	Passed by House June 7, 1937. Reported from Senate Committee on Irrigation and Reclamation on June 22, 1937.
H. R. 2537	To appropriate funds to the Resettlement Administration for the purpose of assisting farmers in the drought area to purchase feed for the livestock and seed for the planting of crops.	Mr. Gehrmann	do	Referred to Committee on Agriculture.
H. R. 2545	Providing for equalization of taxes in counties where there are Government-owned lands.	Mr. Whelchel	do	Referred to Committee on Public Lands.
H. R. 2562	For the relief of Mr. and Mrs. David Stoppel	Mr. Case	do	Approved by President. Private.
H. R. 2700 (see references under H. R. 1590).	Extending the classified civil service of the United States	Mr. Ramspeck	Jan. 12, 1937	Referred to Committee on Civil Service.
H. R. 2712 (see also H. R. 1602, H. R. 5363).	To amend an act entitled 'An act to provide compensation for employees of the United States suffering injuries while in the performance of their duties, and for other purposes", approved Sept. 7, 1916, and acts in amendment thereof.	Mr. Kennedy	do	Referred to Committee on Judiciary.
H. R. 2727 (see references under H. R. 258).	To establish a Board of Civil Service Appeals and to amend an act entitled "An act to provide for the classification of civilian positions within the District of Columbia and in the field service", approved Mar. 4, 1923, and for other purposes.	Mr. Randolph	do	Referred to Committee on Civil Service.
H. R. 2888	Granting a leave of absence to settlers of homestead lands during the year 1937.	Mr. Mott	Jan. 13, 1937	Passed by House July 19, 1937. Referred to Senate Committee on Public Lands July 20, 1937.
H. R. 2902	To amend section 11 of the act of Mar. 1, 1919 (40 Stat. 1270).	Mr. Ramspeck	do	Referred to Committee on Printing.
H. R. 2903 (see references under H. R. 273).	To provide for the extension of the Classification Act of 1923, as amended, to the field services and other establishments of the Government, to amend the Classification Act of 1923, as amended, and for other purposes.	do	do	Referred to Committee on Civil Service.

A RECENT press report states that large quantities of driftwood in Lake Mead have been practically eliminated following a month's work on the part of C. C. C. enrollees under the direction of the National Park Service and the workmen of the Grand Canyon-Boulder Dam Tours, Inc. These crews have confined, by the use of booms, practically all of the driftwood in unused side canyons.

ON JUNE 18 a 27,000-pound flying boat, similar to the ones used by the Navy for bombers, landed on Lake Mead. The plane was purchased by Richard Archbald, noted explorer, from the Consolidated Aircraft, San Diego, Calif., and Lake Mead was the delivery point for the sale. This same plane, on June 24 and 25, made the first nonstop flight for a seaplane across the United States.

TWO acres of water hemlock was eradicated on the Orchard Mesa division of the Grand Valley project, Colorado, during June.

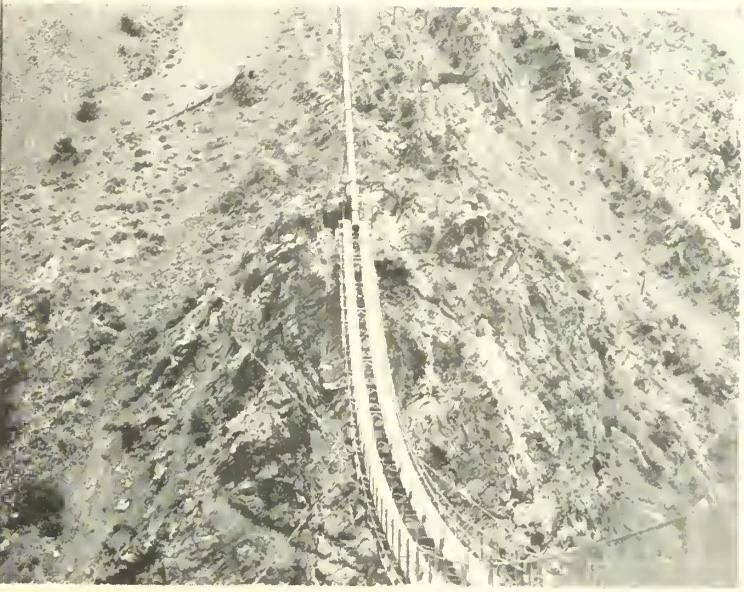
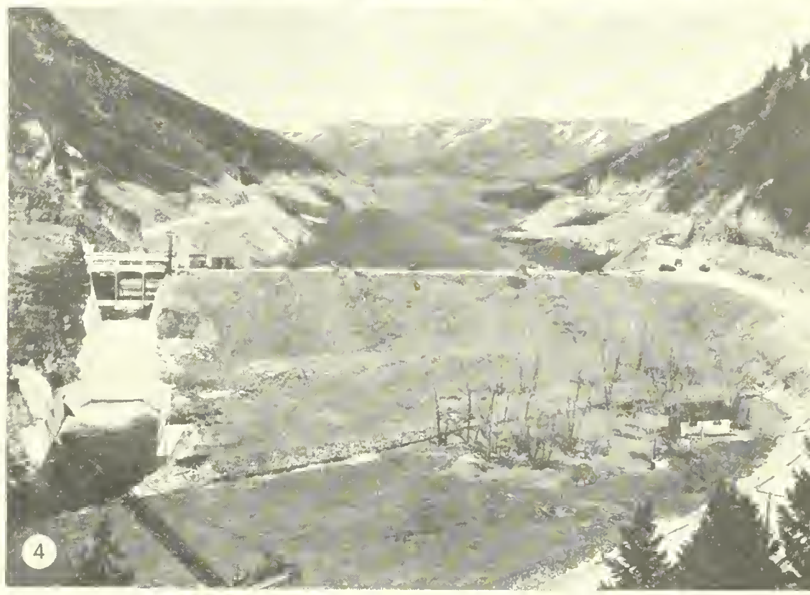
A DISTRICT soil conservation meeting was held at Rapid City, S. Dak., Fourche project), on June 10, in which local farmers participated. The conference was given over to a discussion of plans for the 1938 program under the A. A. A.



VIEWS ON OPPOSITE PAGE

1. PINE VIEW DAM SITE.
2. CUT-OFF TRENCH FROM SOUTH ABUTMENT.
3. OGDEN CANYON SIPHON. VIEW FROM SOUTH SIDE, LOOKING NORTH.
4. PINE VIEW DAM. WATER ELEVATION, 4,849 FEET; STORAGE, 13,263 FEET.



Construction of Pine View Dam, Ogden River Project

By G. C. Imrie, Associate Engineer, Ogden, Utah

THE land adjacent to the river in the lower Ogden River Valley in Utah was first taken up by the early Mormon settlers who irrigated by direct diversion from the river. Later, as the population in this vicinity increased, more land was put under cultivation, with a corresponding increase in the diversion from the river. In recent years, because of this increased diversion, an acute shortage of water during the latter part of each irrigation season has been experienced. Several possible dam and reservoir sites were investigated and at one time actual work was commenced on the Magpie Dam on the South Fork east of Huntsville. Work was also started on the construction of a canal with its intake on the South Fork near Huntsville and located along the south slope of the upper valley. These attempts to secure additional water for the lands of the lower valley failed because of financial difficulties.

In 1922, 1923, and 1924, the possibilities of obtaining a supplemental water supply for the old lands in the upper and lower valleys by the construction of the Magpie Dam were investigated by the Bureau. Again, in 1931 and 1932, the so-called Huntsville Dam and reservoir site was investigated. By the development of this dam and reservoir site, a supplemental water supply could be furnished the lower valley lands as far north as Brigham City.

In 1933, the Ogden River project was authorized for construction. The project comprises a dam across the Ogden River at a point about 8 miles east of Ogden, Weber County, Utah; a 75-inch diameter, continuous, wood-stave pipe line from the dam to the mouth of Ogden Canyon, a distance of 5¼ miles; a concrete-lined canal from the end of the pipe line north about 24 miles to Brigham City, Box Elder County, Utah; a concrete-lined canal from tunnel no. 7 on the pipe line south along the hillside east of Ogden about 6¼ miles to the Ogden municipal airport; the reconstruction of the Ogden City culinary water supply line from Artesian Park, about 9,000 feet upstream from the dam to a point about 1,000 feet downstream from the dam; and replacing the highway to be inundated by constructing about 11 miles of oil-surfaced highway skirting the reservoir on two sides.

PURPOSE OF THE PROJECT

The purpose of the project is to furnish a supplementary water supply to about 17,250 acres of land now under irrigation but having an inadequate water supply, and a full water supply to about 4,500 acres of new land, situated in Weber and Box Elder Counties, adjacent to the cities of Ogden, Willard, Perry, and Brigham City, Utah; and in addition, to furnish 10,000 acre-feet of storage water annually to the city of Ogden for municipal purposes. About 16,150 acres of the land to be supplied with water are situated under 19 old existing irrigation and canal companies which now secure their water supply from the Ogden River, Box Elder Creek, and from small streams arising in the adjacent Wasatch Range; about 3,550 acres are included in the Weber-Box Elder Conservation District and about 2,050 acres

in the South Ogden Conservation District, both of which districts were formed in order to participate in the benefits of the project.

Funds for construction of the project were allotted under the National Industrial Recovery Act of June 16, 1933 (48 Stat., 195), the Public Works Administrator, on August 24, 1933, approving an allotment of $3,000,000. On August 5, 1935, the President approved an additional allotment of $500,000 from the Emergency Relief Appropriation Act of 1935 for continuation of construction. Formal approval of the project by the President was made on November 16, 1935. A contract dated May 31, 1934, was entered into by the United States and the Ogden River Water Users' Association, which provided for construction of the project by the United States and for repayment of the construction cost by the association in equal annual installments in 40 years. By supplemental contracts dated November 30, 1935, and November 27, 1936, the liability of the district was raised from $3,000,000 to $4,200,000, and the method of payment was changed from equal annual installments to a graduated sliding scale of annual installments, as follows: First 10 years, 2 percent; next 10 years 2½ percent; and last 20 years 2¾ percent of the construction cost.

Plans and specifications for the construction of the project were prepared in the Denver office and on September 5, 1934, bids were opened at Ogden for construction of the Pine View Dam and appurtenant works under Specifications no. 584. A contract covering this work was awarded on September 13, 1934, to the Utah Construction Company, of Ogden, Utah, and Morrison-Knudsen Company, Incorporated, of Boise, Idaho, the low bidders, on their joint bid of, $677,898.10. Work on the dam was started late in October 1934.

DAM AND APPURTENANT WORKS

The Pine View Dam, which is constructed across the Ogden Canyon immediately upstream from the point where Wheeler Creek Canyon joins Ogden Canyon, creates a reservoir to store about 41,000 acre-feet of the run-off from the North, Middle, and South Forks of the Ogden River. The dam is an earth and rock-fill structure, with a maximum height of 102 feet above the lowest excavation foundation. The water surface of the reservoir is raised 53 feet above normal water surface in the river above the dam. The dam crest, at elevation 4,879, is 30 feet wide and about 500 feet long. The upstream slope of the earth-fill is 3:1 and is covered with a 3-foot layer of dumped riprap. The downstream slope of the earth-fill is 1½:1 on which is laid a dumped rock-fill section having a slope of 2¾:1 to elevation 4,835, and an 8:1 slope below that elevation. From the upstream toe to the downstream toe of the dam is about 440 feet.

DIVERSION TUNNEL

The diversion tunnel, located in the right abutment, is excavated through a hard limestone and quartzite formation. It has a horseshoe shaped section, is about 600 feet long, and is lined with concrete throughout its entire length. The control gates, which consist of two 4 by 5 feet and one 5 by 6 feet high-pressure, hydraulically-operated, leaf gates, are installed in the tunnel plug, over which the gate chamber is located. Control mechanism for the high-pressure gates is located in the control house on the right side of the spillway, near the axis of the dam.

SPILLWAY

The spillway structure 409 feet in length, is located through the limestone and quartzite rock in the right abutment, and has a discharge capacity of 10,000 cubic feet per second. It is regulated by three radial gates, each 17 feet wide by 17 feet high, installed in the intake to the spillway and operated by automatic, electrically-controlled gate hoists installed on the operating platform constructed over the spillway immediately upstream from the dam axis. The spillway is a reinforced, concrete-lined, open chute type, the design of which was prepared in the Denver office after hydraulic studies of models had been made. The stilling basin is 96 feet long, 39 feet deep, has a 40-foot bottom width, and 1¼:1 side slopes. The water cushion in the pool is 19 feet deep. The channel of the river was relocated from the downstream end of the stilling pool for a distance of 850 feet. The new channel has a 50-foot bottom width, with 1½:1 side slopes. For a distance of 160 feet, the new channel is lined with concrete rubble paving 3 feet thick and for the next 100 feet the channel is lined with dumped riprap 3 feet thick. The channel of Wheeler Creek, a small side stream entering the Ogden River below the dam, was relocated and now enters the river in the concrete rubble paved section. The Eden highway over the crest of the dam, crosses the spillway on a reinforced concrete bridge, immediately downstream from the radial gate operating platform.

FOUNDATION

The entire area under the dam was stripped to a sufficient depth to remove all materials not suitable for the foundation of the dam. A cut-off trench was excavated under the upstream portion of the dam. In the bottom of the cut-off trench, steel sheet piling was driven to bedrock, the center line of the piling being 100 feet upstream from the axis of the dam. During the excavation of the cut-off trench, several spring areas were uncovered. After completing the driving of the sheet piling, the trench was drained by installing tile drains and well points. The drainage system consisted of three main drains and feeders laid in gravel. Well points were driven into all of the spring areas with the outlet pipe carried to points above the rolled embankment. The three main drains terminated in an 8 by 8-foot sump lined with steel sheet piling and located upstream from the steel sheet piling cut-off, at the right abutment. After the earth-fill had been placed to elevation 4,845, concrete was tremied into the sump to elevation 4,800 and the tile drains and well points were then grouted with neat cement.

In order to insure a contact of the sheet piling with the foundation rock in the left abutment, a stope 4 feet in width was excavated adjacent to the line of sheet piling from the bottom of the cut-off trench, through the sand, gravel, and boulder overburden to a contact with solid rock. The stope was then carried up the rock slope to the top of the dam. The stope was excavated at all points to a contact with the bottom of the sheet piling. Grout holes on 5-foot centers were drilled into the rock in the bottom of the stope and were grouted after the stope had been backfilled with concrete to a point at least 10 feet above the top of the grout hole.

During the excavation of the foundation, the contractor carried the flow of Ogden River over the foundation in a timber flume. In the winter and spring of 1936, an unprecedented snowfall occurred in the upper reaches of the Ogden River watershed, and during the spring run-off the flow of the river was 1,000 cubic feet per second larger than any previous flood of record. On April 13, 1936, the flume broke apart at a point immediately downstream from the cut-off trench, flooding the foundation. The upper section of the flume remained in place, thereby averting a complete filling of the cut-off trench with debris carried by the flood. On June 18, 1936, the river was diverted through the diversion tunnel and the contractor started to repair the damage caused by the flood.

On August 20, 1936, the contractor, having completed all damage caused by the flood, and having dried up the cut-off trench by the installation of the drainage system, commenced the placing of the earth-fill. As a protection for the tile drains, a 5-foot blanket of uncompacted

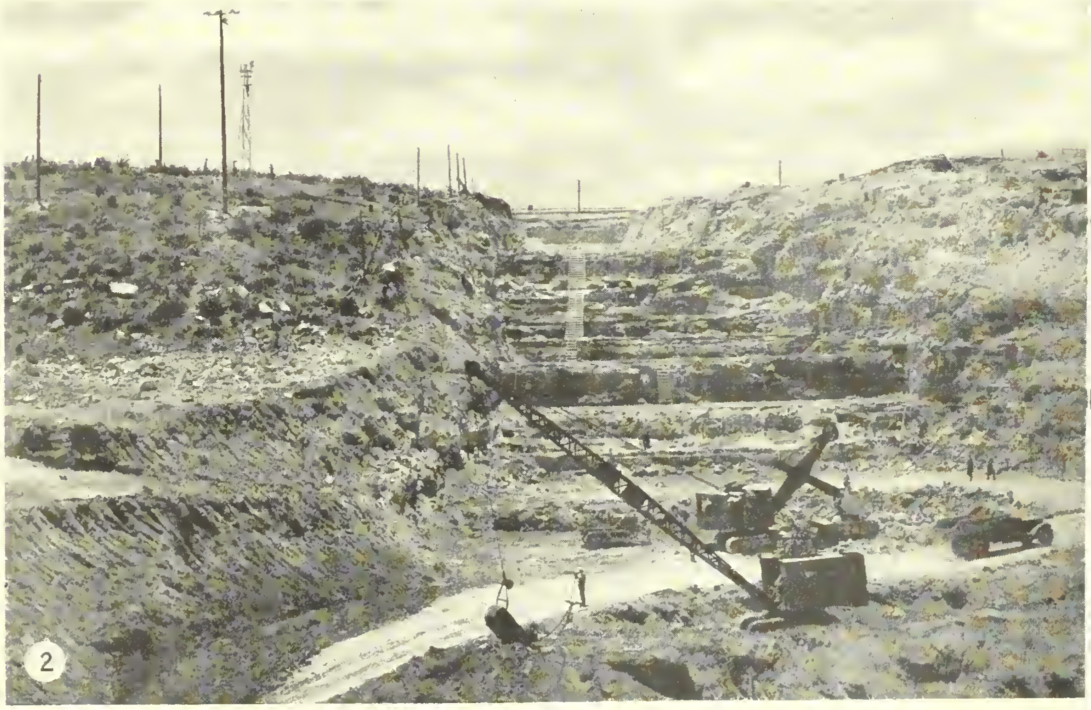
clay material from the White Tavern borrow pit was placed in the bottom of the cut-off trench. Above this blanket the fill material was dumped in windrows 10 feet apart with an average spacing between loads of about 14 feet. When these windrows had been spread by the bulldozer and rolled, an average 5-inch layer of compacted material was obtained. The fill material, as it came from the pits, was deficient in moisture and the contractor applied additional water on the fill during the dumping and spreading operations. After spreading, each layer was compacted by making 10 passes with standard sheepsfoot double-drum rolling units. In places where the sheepsfoot roller could not be used, the tamping was done with back-fill power tampers. The earth embankment was completed on October 16, 1936.

The 3 feet of dumped riprap covering the upstream face and the rock-fill on the downstream face of the earth embankment were placed at the same time as the earth-fill, the top of the rock sections being kept a few feet below the top of the earth-fill. Material used in the rock-fill and the riprap were excavated from the spillway and the Eden Highway tunnel.

Embankment material was obtained from two borrow pits, the White Tavern pit, located about 1¼ miles upstream from the dam, and the Upper Shanghai borrow pit, located about ¼ of a mile upstream from the dam on the north side of the canyon. The White Tavern deposit was an alluvial outwash overlying a very fine clay and consisted of clay, sand, and gravel, with no particular stratification. The Upper Shanghai pit was also an alluvial outwash with the lower portion consisting of horizontal strata of sand, silt, gravel, and clay. About 92,000 cubic yards of material were taken from the White Tavern pit and about 158,000 cubic yards of material from the Shanghai pit.

After completing the dam section, the contractor had considerable work to do on the high pressure and control gates, installation of the 60-inch diameter plate-steel outlet pipe, and the 72-inch diameter plate-steel penstock pipe. Most of this work had been completed on July 1, 1937, but the contract had not yet been accepted.

The estimated cost of the Pine View Dam is $1,382,900.00.



COLORADO RIVER PROJECT IN TEXAS
MARSHALL FORD DAM.

1. RIGHT ABUTMENT. EXCAVATION WORK IN PROGRESS.
2. EXCAVATION WORK ON LEFT ABUTMENT. THE POWER SHOVEL, BULLDOZER, AND DUMP TRUCKS ARE HANDLING ROCK EXCAVATION, AND THE DRAGLINE THE WET, COMMON MATERIAL IN THE FOREGROUND.
3. LAYING RAIL FOR THE CONTRACTOR'S CONSTRUCTION RAILROAD ABOUT 3 MILES FROM THE MARSHALL FORD DAM SITE.

Eight Thousand Miles of Reclamation Projects

An Engineer's Odyssey

By Lewis G. Smith, Junior Engineer, U. S. Bureau of Reclamation

FOR A junior engineer newly attached to the Reclamation office at Denver, vacation offers a marvelous opportunity to see embodied in the field some of those structures which, in spite of blueprints, remain somewhat fantastic as vizualized on a drafting board. Hence, in April an inexpensive vacation trip by car was planned to cover 20 reclamation projects and include 35 dams in all stages of construction. The itinerary comprised a loop of the four major drainage basins of the Western States; namely, the Rio Grande, the Colorado, the Central Valley of California, and the Columbia. The trip was easily made in a month's time with a car arranged with bed accommodations so as to be independent of hotels, and not only were all the projects visited, with time for inspection and the taking of pictures, but also there was ample time to enjoy the beauties of many of the national parks. Such a trip brings out better than perhaps any other method the enormous benefits and the vital influence that reclamation has had on all the Western States, an influence which the original sponsors of the Reclamation Act could hardly have visioned. This account of the trip attempts to point out some of the interesting engineering features and the present status of the projects, for the benefit of others who may wish to spend a profitable and most enjoyable vacation.

Rio Grande.—April 1, 1937, was the date of departure from Denver, Colo. Traveling in the direction of the Rio Grande Basin, the valley between Albuquerque and Socorro, N. Mex., known as the Middle Rio Grande Conservancy District, is a region with which the Government will likely be actively concerned in the future. Casual observation revealed that over large areas the ground water table is at or near the surface. Swamps, salt grass, and alkali presented mute testimony of the retrogression of what were once cultivated fields. In many places it was plainly seen that the river is about 4 feet higher than the surrounding valley floor. The whole problem apparently involves a comprehensive program, including drainage, irrigation, and flood protection.

The effect of recent dry years was evident at Elephant Butte Dam, where the water surface of the reservoir was considerably lower than elevations reached formerly. Inquiry revealed that the lake has not spilled since 1924.

Elephant Butte Lake, as a recreation center, is becoming increasingly popular to the residents of New Mexico and Texas. Roads in the vicinity have been improved by the Civilian Conservation Corps, making the area easily and safely accessible, and the National Park Service has arranged for guest cabins in its future development plans for the recreational area around the lake.

Twenty miles downstream from Elephant Butte is the scene of construction of Caballo Dam. This earth-fill structure will store irrigation water released through future power units at Elephant Butte Dam. The outlet-diversion tunnel was nearing completion, and preparations prior to placing the earth embankment were in progress.

Along the river valley below Caballo (picture no. 1) was convincing evidence of the benefits derived from reclamation. Here, as on most other projects, raw land gave way to green fields with surprising suddenness. At Las Cruces, N. Mex., the road lay west, passing through the prosperous farming country around Safford, Ariz., touching Coolidge Dam, and then joining the Apache Trail to the dams on the Salt River. At Roosevelt Dam final adjustments and operation tests were being made on its new radial spillway gates.

Salt River.—Combined with the delights of the rugged mountain scenery of the Apache Trail, three interesting spillway alteration jobs were readily visited; namely, the newly completed spillway at Stewart Mountain Dam, Horse Mesa Dam, and Mormon Flat Dam.

In the district around Phoenix, Ariz., was an example of a highly progressive irrigated center which had its beginning before the advent of the Spanish explorers. Additional water storage for this area will be effected upon the completion of Bartlett Dam, now under construction on the Verde River, north of Phoenix. Bartlett portrays the modern trend toward hollow dams, where foundation conditions permit. Interesting is the contrast between this dam and the huge Roosevelt Dam of the rubble-masonry gravity type, the latter being only 14 feet higher. Several of the huge buttresses which will support the arches on the upstream face of Bartlett Dam (picture no. 2) are now arising from excellent rock bottom. High up on the west bank curves the completed excavation for the super-elevated spillway, 170 feet in width. The concrete in the dam is pumped from the mixing plant through pipes to the forms. It is placed during the night hours only, since the extreme heat of the day would render the concrete unsatisfactory.

Gila.—On both sides of the road, from Stanwix, Ariz., to Yuma, lies the sloping desert land proposed for irrgation under the Gila project. The ultimate development of 500,000 acres in this section contemplates a maximum pump lift of 500 feet, taking water from the Colorado River at Imperial Dam.

All-American Canal.—In the Yuma district the dreams of a dependable water supply by the early irrigators who waged annual battles with floods and drouths have come true. With Boulder Dam in place, assuring a uniform water supply, extensive irrigation activities are now in progress. The All-American Canal, now under construction as part of the Boulder Canyon project, is in keeping with the American policy of doing the job on a giant scale, with far-sighted planning. Winding through sand and rock alike, it will serve 500,000 acres already developed in the Imperial Valley and will also furnish water to the Coachella Canal for the irrigation of 150,000 acres in the Coachella Valley (picture no. 3). A point of interest associated with the canal is that of the huge walking excavators. An experience long remembered is that of viewing the bucket from the control cabin as it goes through its gymnastics 175 feet away.

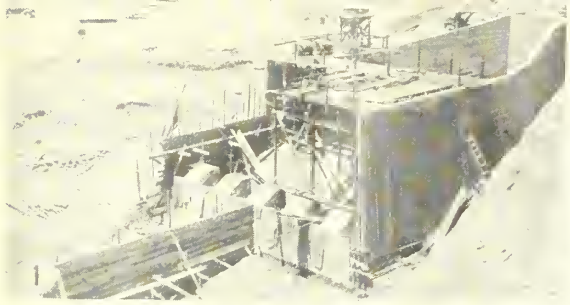
Imperial Dam, now under construction 15 miles north of Yuma, Ariz. (picture no. 4) will portion the waters of the Colorado River three ways, feeding the All-American Canal on the California side, the Gila Canal on the Arizona side, and allowing the remainder to continue its natural course to Laguna Dam where water is now diverted for the Yuma project. Unique in design is this hollow diversion dam resting on concrete piles driven into river sand. Certain of the gate sections were nearing finished form, and outlines of the expansive desilting works on the California side could be seen. To cover the entire job by foot is a challenge to a hiker's ability.

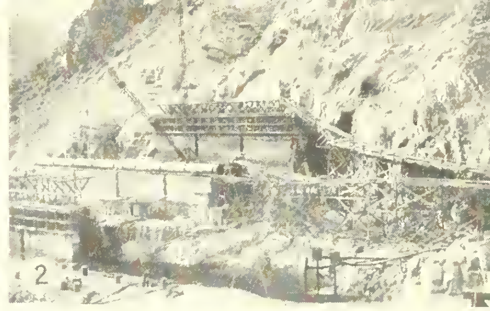
Boulder Canyon.—No trip to the southwest would be complete without visiting Boulder Dam. Aside from its economic bearing and structural dignity, it cannot fail to awake in an engineer mental contrasts of the differences between controlled and destructive energy. Boulder Dam has forever harnessed energy, once running confused and uncontrolled, to the routine work of mankind.

Central Valley.—Six days were spent in the Central Valley of California, where perhaps the greatest of all dramas of reclamation is being enacted. The prologue presents a valley floor exceeding 19,000 square miles, upon whose rich soil an aggressive agricultural population has settled. The wide variety of food products has made it one of the most important agricultural districts in the country. As the valley developed and surface waters were no longer adequate, the farmers resorted to pumping from underground. At present the water pumped out exceeds that which is slowly percolating in, with the consequent lowering of the water table. In the vicinity of Visalia, Calif., were seen dead trees of abandoned orchards, the beginning of a condition which threatens much land in the San Joaquin Valley. In hand with this is the encroachment of salt water into the rich lands of the Sacramento-San Joaquin delta region.

The orderly plan of development, on which construction will soon start, will not only remedy immediate needs but will also provide flood control. The two principal rivers, the Sacramento in the north and the San Joaquin in the south, now flow unregulated. Under the project contemplated their waters will be held in check by the Kennett Dam on the Sacramento and the Friant Dam on the San Joaquin. A visit to both of these dam sites proved most interesting. A glance upstream from the top of the canyon walls at the sites indicated their enormous reservoir basins. In spite of the relative broadness of the canyons, one is impressed with the excellence of the dam-site locations.

The magnetic pull of two of the world's greatest bridges made a stay in San Francisco seem essential. A visit to Yosemite was made enroute (picture no. 5). However, the heavy fog caused the writer to hasten northward through the enchanting vineyards near Calistoga and up to Stony Gorge Dam, the principal structure on the Orland project. Stony Gorge exhibits gracefully the merits of an Ambursen, or slab and buttress type dam, and is conspicuous for its water-tightness.





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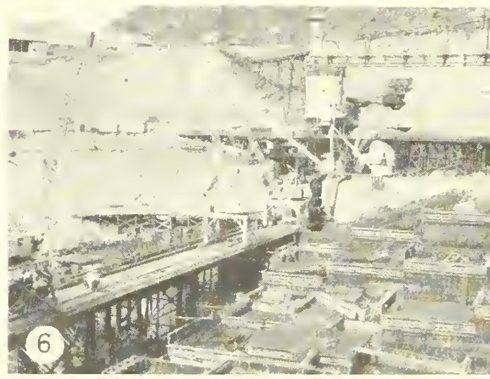


1. OUTLET STILLING POOL, CABALLO DAM RIO GRANDE PROJECT, N. MEX.-TEX.
2. BARTLETT DAM, ON VERDE RIVER, SALT RIVER PROJECT, ARIZONA.
3. ALL-AMERICAN CANAL, ARIZONA-CALIFORNIA.
4. HEADGATES FOR DESILTING WORKS, IMPERIAL DAM.
5. YOSEMITE NATIONAL PARK.
6. GRAND COULEE DAM, COLUMBIA BASIN PROJECT, WASHINGTON.
7. KACHESS DAM, YAKIMA PROJECT, WASHINGTON.
8. EARLY STAGES OF A RECLAMATION FARM ON THE OWYHEE PROJECT, OREG.-IDAHO.
9. MINIDOKA DIVERSION DAM, MINIDOKA PROJECT, IDAHO
10. PROPOSED COLORADO-BIG THOMPSON TRANSMOUNTAIN DIVERSION PROJECT.

Upon returning to the main highway at Willows, Calif., the majestic white cone of Mount Shasta came faintly into view. At a distance of 150 miles it appeared as a ghost mountain and played a game of hide and seek the remainder of the day.

Klamath.—Dropping into the Klamath Falls district from the Cascade Mountains brought an abrupt change from the midsummer weather heretofore encountered to that of early spring. The Klamath project differs from most reclamation undertakings, in that part of its developed land includes drained lake bed.

Jewel-like in her high sculptured setting and still wearing her winter mantle was Crater Lake. Geologists claim that no human eye ever saw Mount Mazama, a volcano of the Cascades, which either exploded or collapsed into itself leaving this caldera 6 miles in diameter.

The rolling hills near Madras, Oreg., presented an impressive picture in the battle of the Resettlement Administration against land misuse and rural poverty. Submarginal land which never should have felt the plow is being reverted to pasture land, and farmers are being moved to productive ground under Government guidance.

Columbia Basin.—The first contact with the Columbia River Basin and its long-range plan for development was made at Bonneville Dam. This is one of the 10 dams planned to utilize 92 percent of the available fall of the river within the United States. Though it was a rainy day, it failed to dampen one's appreciation of this mighty structure, now nearing completion under Army supervision. This dam has a strategic location at an island point in the river 36 miles east of Portland, Oreg. In the main or north channel stand the huge piers like soldiers of a well-fed army at parade rest. They shoulder the 50- by 50-foot lift gates now in the process of assembly. The power house and canal locks share one's interest when looking toward the south channel, but the extensive fish ladders hold the stage on the island.

By far the largest and most important dam in the comprehensive development planned for the Columbia River is Grand Coulee, now at the peak of construction. However, one's first glimpse of it from the highway at present reveals only a small dentated weir in comparison with the immensity of the surrounding topographical features. Relative to the ancient ice barrier which once obstructed the flow of the Columbia River at the same point, it will be but a pigmy. But whereas water diverted by the glacier cutting its way through successive lava beds to form the Grand Coulee served only to carve a laboratory for present-day geologists, the man-made diversion through the same channel will mold the lives of a future population of hundreds of thousands of people. Only when standing on the rock foundation (picture no. 6) and looking upward does the immensity of the dam become apparent. Here is embodied the boldness and daring of present-day visionary planning. Initiated by one generation, the project will be completed by the next.

Yakima.—From Grand Coulee the route turns southwest to the Yakima project. Keechelus, Kachess, Cle Elum, Clear Creek, Easton, Bumping Lake, and Tieton Dams all have their backs to the inspiring eastern slopes of the Cascade Range. Just as the blossoms precede the fruit, so the beauty of these snow caps become practical sustenance for the valley below, the dams making the interchange possible.

Enlargement of this project (picture no. 7) was evidenced by the construction of the Roza Canal. It was a wild ride into one of the tunnels of this job, jouncing along a crude track with the clatter of empty cars ahead and seepage water falling like rain from the dark roof above. At the tunnel heading was the deafening drone of pneumatic drill hammers; miners, like doctors in black, were working in raincoats, real soldiers in the cause of reclamation.

The Snake River is the principal tributary of the Columbia River from the south. Along its banks and tributaries are seven main projects, which appear in the following order in the upstream direction: Baker, Burnt River, Owyhee, Vale, Boise-Payette, Minidoka, and Upper Snake.

Clustered together and now operated as a regional group are Boise, Owyhee, and Vale, forming the largest of the Government projects. Owyhee is a recent addition to the family and contains many acres of irrigated land ready for further development by the farmer. Much of this land is being resettled by the people from the Dust Bowl area. In the vicinity of Ontario and Nyssa, Oreg., were seen their crude dwellings, the forerunners of a prosperous community to come (picture no. 8). These were like sprouts of new roots in a strange land. Although the present condition of these people appears hard, life is far richer here than back home. Now they have water, producible land on which rests their faith in the future, and, what is important to them, clean air to breathe. Notable features visited on the Owyhee project were the Owyhee Dam and the Malheur River Siphon.

Boise.—The present program of expansion of the Boise project involves 47,000 acres on the new Payette division. The Payette Canal is now under construction and will take water from the Black Canyon reservoir. This canal will necessitate additional storage above the Black Canyon, which is receiving investigational study at present. The reservoir anticipated is at Garden Valley in the upper reaches of the Payette River. The storage water for the Boise project at Arrowrock Dam is being increased by raising the dam 5 feet. At the same time, improvements are being made on the downstream face.

Minidoka.—The Minidoka project, in the lower saddle of the Snake River, was next in line (picture no. 9). A pilgrimage was made to its three principal dams, Minidoka, American Falls, and Jackson Lake.

Upper Snake River storage.—The demand for supplemental water for late season crops, combined with need for flood control, lead to the creation of the Upper Snake River storage project in eastern Idaho. Its two partially completed storage dams, Island Park and Grassy Lake, are just emerging from their winter hibernation. Both are of the rolled earth-fill type. Progress on these dams is slow, because of the short construction season in this part of the country.

From Island Park Dam it was only a short drive into Yellowstone National Park. Although the park was hardly ready to receive summer guests, here for the first time on the trip was an ample supply of hot water with which to shave. After staying for 2 days, and including a side trip to the royal Tetons, exit was made through a snowstorm at Sylvan Pass.

Shoshone.—The spectacular erosional fantasies of Shoshone Canyon, leading from Yellowstone, terminated at Shoshone Dam. This thin concrete arch dam, situated in a narrow steep-walled canyon, provides storage of the Shoshone project. Of the five divisions comprising this project, three are now complete. The two remaining divisions will receive impetus upon completion of the Shoshone Canyon conduit, now worming its way through the canyon walls 100 feet above river-bed elevation.

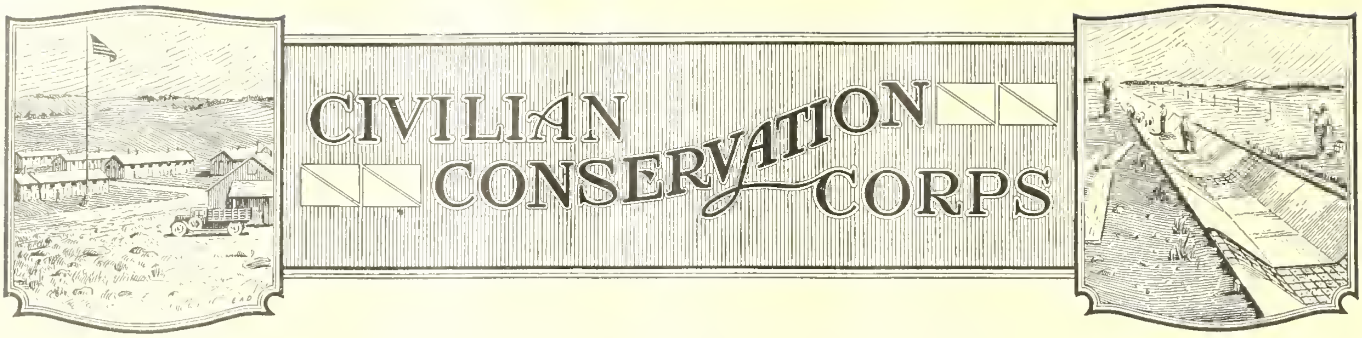
Riverton, Casper-Alcova, North Platte.—By losing latitude in the central part of Wyoming, the Riverton, Casper-Alcova, and North Platte projects were encountered. Additional land is constantly being developed at Riverton by the construction of new canals. Over one-half of the irrigable area is Government owned and is open for public sale or homestead to those meeting entry requirements. The Casper-Alcova project is a recent undertaking involving irrigation, power de-

(Continued on p. 192)

Notes for Contractors

Specification no.	Project	Bids opened	Work or material	Low bidders: Name	Low bidders: Address	Bid	Terms	Contract awarded
728	All-American Canal, Calif.	June 7	Structures, sta. 3825+80 to 4242+85.	Bennett and Taylor	Los Angeles, Calif.	$64,425.00		July 3
735	Colorado River, Tex.	June 24	1 bulkhead gate and 24 bulkhead gate frame and track assemblies for outlet works at Marshall Ford Dam	Koppers Co. (Bartlett-Hayward division).	Baltimore, Md.	163,960.00	Discount ½ percent.	July 12
738	Columbia Basin, Wash.	June 2	1 bulkhead gate and 16 bulkhead gate frame and track assemblies for Grand Coulee Dam.	American Bridge Co.	Denver, Colo.	56,267.00		June 17
739	do	June 3	Trashrack metal work for outlet works at Grand Coulee Dam.	Arthur J. O'Leary & Son Co.	Chicago, Ill.	[1] 54,200.00	Discount ½ percent.	June 25
						[2] 8,250.00	Discount ½ percent.	Do.
913-D	Truckee Storage, Nev.-Calif.	Apr. 30	Furnishing sand (11,000 tons) and gravel (18,000 tons) for Boca Dam.	Yuba River Sand Co.	Marysville, Calif.	[3] 4,400.00		June 29
				Smith, Peterson & Co.	Reno, Nev.	[4] 11,700.00		Do.
915-D	Yakima-Roza, Wash.	May 4	Furnishing sand (28,000 tons) and gravel (45,000 tons).	Yakima Sand & Gravel Co.	Yakima, Wash.	[5] 57,450.00		June 30
927-D	All-American Canal, Ariz.-Calif.	May 27	Twelve 12,000-pounds capacity, single-drum, radial-gate hoists, and fourteen 20,000-pounds capacity, double-drum, radial-gate hoists.	Commercial Iron Works.	Portland, Oreg.	[6] 31,999.00	Discount ½ percent.	Do.
929-D	Casper-Alcova, Wyo.	June 3	One 50-ton motor-operated, overhead traveling crane with 10-ton auxiliary hoist.	Cyclops Iron Works	San Francisco, Calif.	19,300.00	do.	June 25
930-D	do	June 15	Four 2-500 kv-a, 6,900 to 39,840/69,000 Y-volt transformers; four 667 kv-a, 6,900 to 19,920/34,500 Y-volt transformers; three 100 kv-a, 6,900 to 2,400-volt transformers; three 100 kv-a, 6,900 to 240/120-volt transformers; one 50 kv-a, 6,900 to 240/120-volt transformer.	Kuhlman Electric Co	Bay City, Mich.	[1] 25,776.00		July 9
				Pennsylvania Transformer Co.	Pittsburgh, Pa.	[2] 10,040.00		Do.
				American Transformer Co.	Newark, N. J.	[7] 3,670.00		Do.
932-D	All-American Canal, Ariz.-Calif.	June 18	Piping, storage tank, and appurtenances for industrial and drinking water systems for Imperial Dam and desilting works.	Crane-O'Fallon Co.	Denver, Colo.	[1] 7,450.00	Discount 2 percent	June 25
				Southwest Welding & Manufacturing Co.	Alhambra, Calif.	[2] 1,232.00	Discount ½ percent	June 26
933-D	Gila, Ariz.	June 17	Gate frames and curb frames for 8 sluice gates and 8 diversion gates for basin no. 3, Gila Valley Canal desilting works.	Worden Allen Co.	Milwaukee, Wis.	6,490.00	do.	June 25
936-B	Shoshone-Heart Mountain, Wyo.	June 23	43,000 barrels of Portland cement (sulfate-resistant) in cloth sacks.	Monolith Portland Midwest Co.	Denver, Colo.	110,940.00	50 cents discount and sacks f. o. b. Laramie, Wyo.	July 13
938-D	Casper-Alcova, Wyo.	June 28	Three 14-foot by 50-foot fixed wheel gates or spillway at Seminoe Dam.	John W. Beam	do	16,000.00	Discount ½ percent, f. o. b. Peotone, Ill.	July 12
42,717-A	Salt River, Ariz.	June 11	Steel reinforcement bars, 1,350,305 pounds.	Colorado Fuel & Iron Corporation.	Minnequa, Colo.	40,104.06	Discount ½ percent of b. p. v. $2.70, f. o. b. Phoenix, Ariz.	June 29
A-42,256-A	All-American Canal, Ariz.-Calif.	May 28	Steel reinforcement bars, 960,987 pounds.	Columbia Steel Co.	Torrance, Calif.	27,700.06	Discount ½ percent b. p. v., f. o. b. Calexico, Calif.	June 30
730	Boulder Canyon, Ariz.-Nev.	May 3	230,000-volt oil circuit breakers and disconnecting switches.	Pacific Electric Manufacturing Corporation.	San Francisco, Calif.	[8] 52,469.65	F. o. b. Boulder City	July 17
727	Do.	June 14	69,000-volt load-ratio-control transformers; oil circuit breakers and lightning arresters; 138,000-volt disconnecting switches; 16,500-volt potential transformers and disconnecting switches.	Pennsylvania Transformer Co.	Pittsburgh, Pa.	[10] 45,000.00	do.	July 24
				Pacific Electric Manufacturing Corporation.	San Francisco, Calif.	[11] 18,300.00	do	Do.
				General Electric Co.	Schenectady, N. Y.	[7] 1,571.49	do	Do.
				Delta Star Electric Co.	Chicago, Ill.	[12] 6,423.00	do	Do.
				Allis-Chalmers Manufacturing Co.	Milwaukee, Wis.	[13] 513.88	do	Do.
				General Electric Co.	Schenectady, N. Y.	[14] 1,021.65	do	Do.
				Johnson Manufacturing Co.	Atlanta, Ga.	[15] 320.95	do	Do.
732	Do.	June 14	Two 82,500 kv.-a. generators (A-6 and A-7) for Boulder power plant.	Westinghouse Electric & Manufacturing Co.	E. Pittsburgh, Pa.	1,467,000.00	Installed	Do.
737	All-American Canal, Calif.-Ariz.	June 28	Construction of Pilot Knob check and wasteway.	V. R. Dennis Construction Co.	San Diego, Calif.	314,590.00		Do.
733	Boulder Canyon, Ariz.-Nev.	June 1	Transformers for units A-6 and A-7, Boulder power plant.	General Electric Co.	Schenectady, N. Y.	[6] 57,420.00	F. o. b. Boulder City	July 17
734	Do.	June 14	Hydraulic turbines and governors for units A-6 and A-7, Boulder power plant.	Allis-Chalmers Manufacturing Co.	Milwaukee, Wis.	1,033,640.00	F. o. b. West Allis, Wis.	Do.
941-D	Upper Snake River, Idaho-Wyo.	July 7	Construction of relocated road at Grassy Lake reservoir.	Lobnitz Bros.	Wolf Point, Mont.	7,680.50		July 15
944-D	Owyhee, Oreg.-Idaho.	July 14	Earthwork and structures, North Canal laterals.	David A. Richardson	Ontario, Oreg.	9,759.00		July 20
937-D	Salt River, Ariz.	June 24	Earthwork, canal lining and structures, Roosevelt power canal.	Gates & Huntley	Los Angeles, Calif.	78,750.00		July 21
A-33,640-A	Yakima-Roza, Wash.	June 30	9,600 bbls. of portland cement in cloth sacks.	Superior Portland Cement Co., Inc.	Seattle, Wash.	19,680.00	50 cents discount and sacks f. o. b. Seattle.	Do.
2,310-B	Carlsbad, N. Mex.	July 1	4,000 bbls. of portland cement in cloth sacks.	Southwestern Portland Cement Co.	El Paso, Tex.	12,432.71	50 cents discount and sacks.	July 16
A-22,051-B	Casper-Alcova, Wyo.	July 7	5,000 bbls. of portland cement in cloth sacks.	Monolith Portland Midwest Co.	Denver, Colo.	11,410.00	do	July 12

[1] Item 1. [2] Item 2. [3] Schedule 1. [4] Schedule 3. [5] Schedules 1 and 4. [6] Items 1 and 2. [7] Item 3.



C. C. C. and Emergency Work

By Alfred R. Golzé, Supervising Engineer, C. C. C.

CERTAIN emergency activities of the Civilian Conservation Corps are familiar to nearly everyone. The splendid work of the boys in combating forest fires and assisting in major flood catastrophes has received much national publicity; but little attention, other than in the immediate localities, has been given the equally fine work of the corps on the reclamation projects of the far West.

CANAL BREAKS

The most common emergency arising on a reclamation project is a break suddenly occurring in a canal bank. Breaks in canal banks usually result from the tunneling activities of rodents, pocket gophers for example, which allow the canal waters to break through. Similar breaks are sometimes caused by porous soils permitting leaks that, not discovered in time, gradually grow until the force of the water is sufficient to wash away an entire section of bank.

Such breaks, apart from the loss of valuable irrigation water and flooding of the adjacent farm land, may often become more serious if not repaired promptly, by causing crop failures on the many farms served by the canal being deprived of irrigation water. On those reclamation projects which have C. C. C. camps, the enrollees have rendered yeoman service in emergencies of this type.

On the Klamath project in California and Oregon, this past spring, 10 breaks in canal banks were speedily repaired by enrollees from the 2 camps on that project. Their work was of great value to the project in permitting the early restoration of irrigation-water deliveries.

On the Salt River project in Arizona, a serious break occurred early in April of this year. The north bank of the South Canal, which furnishes irrigation water for the entire 125,000 acres of the Southside Division of the project, was washed out over a 100-foot section. Although the break occurred late on a Saturday afternoon, the enrollees from the two camps on the project worked unceasingly all day Sunday and Monday, with water being turned back into the canal on Tuesday, less than 3 days after failure—an excellent piece of work on a main canal that would have taken much longer without the efficient aid rendered by the C. C. C.

Early in May, C. C. C. enrollees from the camp at Deaver, Wyo., on the Shoshone project, were called upon to assist in the reconstruction of 300 feet of

the inclined drop below the Ralston Reservoir. This work was of unusual importance as the irrigation water for 46,000 acres, including all of the Frannie and most of the Garland Division, passes through the chute. The full force of the camp was used on the reconstruction job until repairs were completed sufficiently to permit release of water from the reservoir.

PREVENTIVE MEASURES

Leaks, when discovered in time, can be plugged or repaired to prevent failure of the canal banks. In the latter part of June, three leaks caused by gopher holes were discovered in the Pathfinder Main Canal of the North Platte project in western Nebraska. C. C. C. enrollees from the camp at Mitchell, Nebr., were hurried to the scene, and by working in relays throughout an afternoon and night, stopped the leakage without the necessity of cutting off the 850 second-feet flow of the canal, thus preventing what unquestionably would have been a serious disaster to the project.

Of a more permanent nature for the prevention of canal bank failures is the extensive program of rodent control, silting, and concrete lining that has been carried on by the C. C. C. boys during the past 2 years. The constantly increasing acreage treated for rodents and the mileage of canals lined with concrete act as the best possible insurance for the water users against destruction of crops by floods or crop failure due to nondelivery of irrigation water and for protection of the Government's large investment in the field of reclamation.

WINTER EMERGENCIES

The exigencies of winter frequently place a heavy demand on the services of C. C. C. enrollees. During the winter of 1936-37, snowfall was unusually heavy in portions of Utah and Nevada, necessitating emergency work by the C. C. C. boys to save human life and protect livestock and property from destruction or damage.

In January, about 50,000 head of sheep were marooned by unusually heavy snow in Pleasant Valley in the Uintah Basin of eastern Utah. A C. C. C. 50-horsepower tractor, with a bulldozer attachment, was loaned to the Utah State Road Commission to open a 26-mile road to rescue the stranded animals. C. C. C. enrollees from the camp at Bridgeland, on the Moon Lake project, accompanied the tractor, working as grease men and oilers. This fine work, which was done in cooperation with the Division of Grazing, prevented what otherwise would have been certain destruction for the large flock.

Stormy subzero weather early in February blocked the roads to many an outlying mining and farming district in western Nevada. Local authorities were unable to cope with conditions, and C. C. C. men and equipment from the reclamation camp at Lovelock, Nev., on the Humboldt project, were made available for rescue work. Working over a 3 weeks' period, C. C. C. enrollees, in cooperation with the county commissioner, cleared 380 miles of road, released 10 towns, 65 snowbound ranchers and miners in outlying sections, and permitted feed to be hauled to many isolated herds of cattle. Without C. C. C. assistance, the severity of the past winter would have been more acutely felt in western Nevada.

OTHER EMERGENCIES

From May 31 to June 9, 1937, all C. C. C. men from the reclamation camp at Carlsbad, N. Mex., were concentrated on emergency flood protection work on McMillan Dam, brought about by extreme flood conditions of the Pecos River. The McMillan Dam, built by private interests before acquisition of the project by the Government, is a storage unit of the Carlsbad project.

UPPER: BREAK IN CANAL BANK SHOWING FLOODED FARM LANDS, KLAMATH PROJECT, OREGON-CALIFORNIA.

LOWER: SAME LOCATION AFTER BREAK REPAIRED BY CCC ENROLLEES.

ILLUSTRATION ON OPPOSITE PAGE.

C. C. C. EQUIPMENT AND MEN ASSISTING PROJECT FORCES IN REPAIRING BREAK IN SOUTH CANAL, SALT RIVER PROJECT, ARIZONA.

On May 31 at 5:30 p. m., a leak, started by the high water, was discovered in the dam, and was stopped by filling and placing sandbags until 11 p. m. Patrol crews of 22 to 24 C. C. C. men were on constant duty at the dam until June 3, when reports of further flood water coming down the valley required the assistance of additional C. C. C. men from nearby Forest Service and Division of Grazing camps. Men from all three camps worked continuously in shifts from the morning of June 4 through to the morning of June 6 placing sandbags on the reservoir face of the dam where leaks might occur at high water.

As a result of the superb emergency work of the C. C. C. enrollees, the dam successfully withstood the pounding flood waters, and the city of Carlsbad, with the surrounding irrigated valley, was saved from damage or destruction.

On June 11, in the area around Billings, Mont., 1½ inches of rain fell in less than an hour and light rain continued throughout the night. The resulting flood swept through the main canal serving 20,000 acres north and west of Billings, flooding a portion of the city, wrecking the canal by washouts and flume destruction, and causing other heavy property damage in that vicinity.

C. C. C. enrollees from the camp at Ballantine on the nearby Huntley project were placed on emergency duty to repair the main canal sufficiently to make it possible to deliver irrigation water to the lands affected. A side camp was established at Billings, and men, tools, and equipment were concentrated on the work, which was successful in saving the crops and preventing what otherwise would have been a second disaster.

A small dam near Austin, Colo., failed on June 13, 1937, before C. C. C. men from the reclamation camp at Montrose on the nearby Uncompahgre project could reach the scene. The town of Austin was partially flooded and many irrigation ditches washed out or silted. C. C. C. enrollees from the reclamation camp and also from the Division of Grazing camp near Montrose assisted in restoring health and sanitation facilities and cleaned and repaired damaged irrigation canals to permit the use of the natural flow of the creek.

Activities of this nature, not on the regular work program schedule of the camps, have done much to prove the value of the Corps to the Nation, and the reclamation projects with C. C. C. camps have a status comparable to the national forests and parks when a real emergency develops that would be beyond the powers or ordinary resources of the community.

Living on the Land

By J. Rupert Mason, San Francisco

IS OUR Government going the best way about things, with the President's recently announced proposal to create seven new T. V. A.'s and to help more of our people to establish homes of their own in existing and new regions, east and west?

This question is all the better worth asking, because we are all becoming conscious that other and older nations, after years of dilly-dallying, now appear convinced that there is no other choice, if the problem of the unemployed is to be solved, and disastrous inflation or national bankruptcy avoided. Most foreign nations are today investing more heavily than ever before in great land reclamation schemes, as well as smaller ones, vast water-storage dams for irrigation, flood control, navigation and power, levees and drainage systems, and forestation projects, all to the end that their people who are seeking to establish and maintain their homes on the land, may suffer less risk of losing their crops by drought, flood, dust storms, soil erosion, etc. In few other nations, however, has the Government found it possible to achieve these objectives by democratic processes because of the inability of powerful vested interests to recognize the vital necessity for cooperating fairly for the common good. Sometimes revolution was necessary to break the grip of the vested financial and land holding interests, and sometimes a dictator has forced compliance.

The accomplishments, however, regardless of what form of government was in control, suggest that our general impression that men who have become accustomed to jobs in the cities, can't make a go of it on the land, may be a bit wrong. If ex-miners can get along on one acre or less, as many thousands are quite successfully doing today in England, Scotland, and Germany, they can undoubtedly if provided with a modest equipment, manage more land and live much better. It is pretty generally recognized abroad today that even when conditions have gotton much better many men and women, formerly employed in factory jobs and mines, will have small chance of ever gaining a livelihood again at their old jobs.

Opportunities afforded to live on the land will be clear gain for all such persons, their families, and for the general welfare. The fact that many farmers have difficulty in making ends meet now, and desire no subsidized competition, is not without much merit. Yet the workers cannot hope to foot the bill of feeding the unemployed much longer, although many seem to imagine that some "Uncle" named Sam or Santa Claus has more money that he can pull out of the hat by merely making a few remarks in Greek.

The main objective of the new seven T. V. A.'s and all land settlement schemes abroad is not to put undue emphasis on the profit motive, and growing for sale the largest possible amount of produce, but rather to swing open the doors of opportunity for a decent, healthy, working life to persons who no longer have a good chance to find such work in factory or mine. As there is no other known place to turn except to the land itself for relief from the mounting cost of supporting the unemployed and keeping them in virtual idleness, we should get enthusiastically back of the President's efforts to restore a vigorous land reclamation and settlement program, where in intelligently planned communities more people may have an opportunity to be content with security, modest homes amid pleasant and healthy surroundings, good neighbors, low cost electricity, good roads, and schools.

The romantic adventure of revealing America is only really beginning. To get the best use of our natural resources for the greatest number must be our goal. Whether we are going to be able to do this by our present existing democratic processes or otherwise, no person now living need doubt that it will be done.

The historic civilizations of this world have invariably been those which longest protected their necessary roots in the soil. We can ill afford to ignore this, the fundamental lesson of all human experience.

Boulder Electrical Engineer Installs Home-Made Air Cooler

A report has reached this office that Robert F. Bourne, a young electrical engineer assigned to the Boulder Canyon project, has put to practical use the information given in the article appearing in the Reclamation Era for August 1936, regarding home-made air coolers, and has built according to specifications an air cooler and installed it in his own home. Mr. Bourne states that the cooler lowers the temperature in his home about 10 degrees.

SEVERAL resales of farm tracts were made during June on the Vale project, Oregon. Approximately 1,000 acres of undeveloped land remain to be sold.

Progress of Investigations of Projects

Blue River transmountain, Colorado.—Hydraulic studies are being made of water supply available for transmountain diversion from the Blue and Williams rivers and of water available in the South Platte River at South Platte for exchange for Western Slope water. Designs were started on a dam for the reservoir just below Dillon, Colo., on the Blue River. Topographic surveys are in progress on the Waterton Reservoir site and were completed on the Dillon dam site. Points were established for horizontal control in the area between Idaho Springs and Platte Canyon. Vertical control is being established for the Waterton Reservoir on South Platte River and the power conduits along Bear Creek. A geological report was completed.

Colorado-Big Thompson, transmountain diversion, Colorado.—A synopsis of the report on these investigations has been printed as Senate Document No. 80.

Eastern slope, Colorado. (*a*) *Cherry Creek irrigation and flood control.*—Topographic surveys for the land classification of the Cherry Creek valley between the Arapahoe Diversion and Kenwood Dam were completed.

(*b*) *Trinidad Irrigation and Flood Control.*—Drilling at the dam site on the Purgatoire River was initiated and completed. A total of 789 feet of hole was drilled.

(*c*) *South Republican River.*—Field surveys for determining the possibilities of diversions for storage from the South Republican River and Landsman's Creek were continued.

(*d*) *Apishapa irrigation reconstruction.*—Topographic surveys of the reservoir site were completed.

A report on Big Sandy Creek is being prepared. This report includes the Hugo Irrigation and Flood Control project and the Chivington Irrigation and Flood Control project.

Western slope, Colorado.—(*a*) *Collbran project.*—Surveys were begun of a proposed canal to the Sunnyside area, contemplating taking water from Plateau Creek across to Buzzard Creek to supply the Colorado Canal which will require reconstruction.

(*b*) *Paonia project.*—Reconnaissance surveys were made on the Smith Fork of the Gunnison River and survey work was outlined for a reservoir site.

(*c*) *Piceance Creek project.*—Topography of the proposed reservoir site and the dam site were completed.

(*d*) *Roan Creek project.*—Stream measurements were continued and preparations were made for testing dam foundation pits.

(*e*) *Silt project.*—Stream measurements were made on four streams. A study of water supply data indicated the necessity for modification of plans for this project.

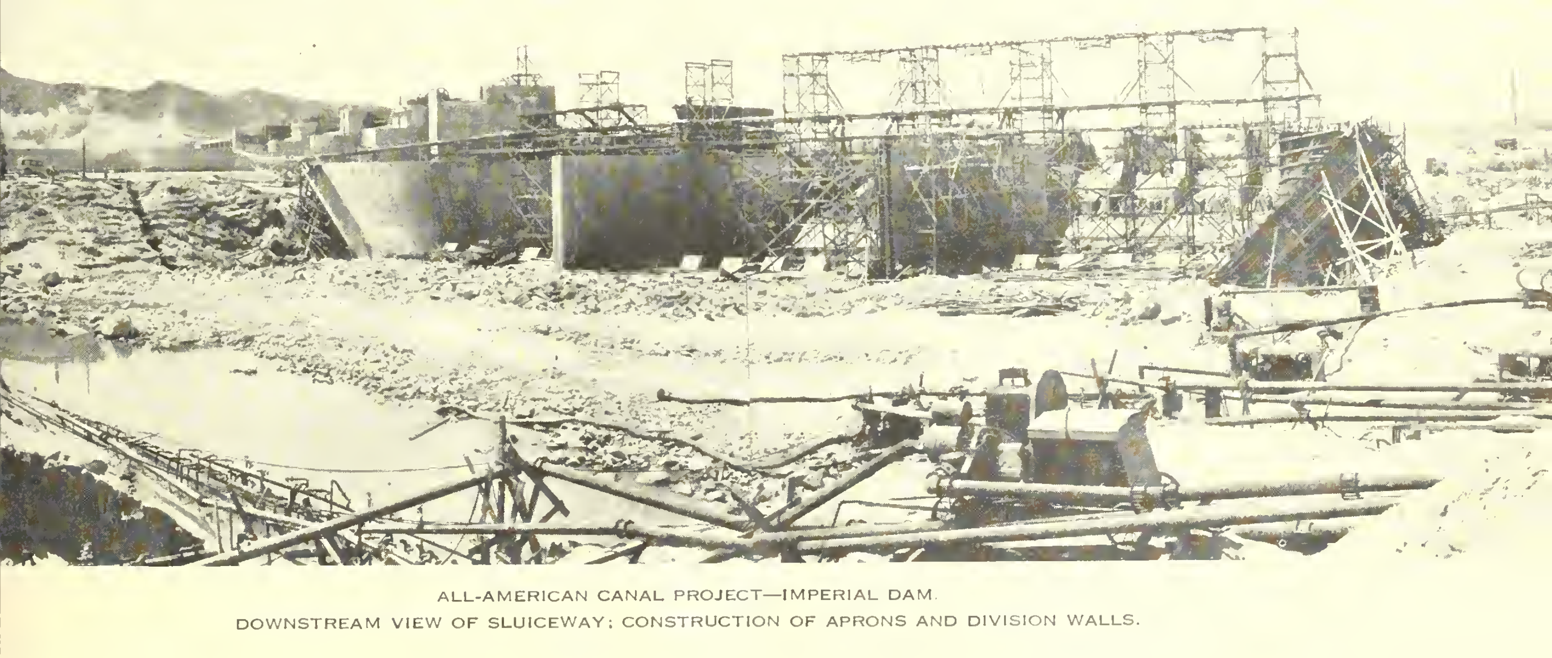
(*f*) *Troublesome project.*—Topographical maps of reservoir sites on the Troublesome and the East Fork were completed. Detail topography was completed of the dam site on the Troublesome. Strip topography is being taken of a proposed canal location. A reconnaissance was made of a proposed canal from Rabbit Ear Creek to the Antelope Creek basin.

(*g*) *West Divide project.*—Stream measurements were made on five streams related to this project.

(*h*) *Yampa project.*—The preliminary estimate for the proposed earth and rock-fill type dam at site no. 1 was completed.

Rio Grande Basin, Colorado-New Mexico.—A resurvey of the Weminuche Pass transmountain diversion was practically completed. Topographic surveys of the Granite dam site and reservoir basin are nearing completion. Studies of power possibilities at Wagon Wheel Gap are in progress. Lines for an alternative location on the San Juan-Chama diversion and surveys of upper and lower Willow Creek and Abiquiu dam sites were completed. Estimates of the alternative San Juan-Chama diversion were completed, and those for the highway relocation around Wagon Wheel Gap Reservoir are in progress. A study was made to determine the amount of storage required on Willow Creek and the Chama River to regulate the discharge of the diversion tunnel from the San Juan. A reservoir and dam site were surveyed in the vicinity of Bridge Range station on the Piedra River. A survey of a prospective reservoir and dam site on Weminuche Creek was completed.

Boise (Boise-Weiser-Payette), Idaho.—(*a*) *Weiser land classification.*—Mapping



ALL-AMERICAN CANAL PROJECT—IMPERIAL DAM.
DOWNSTREAM VIEW OF SLUICEWAY; CONSTRUCTION OF APRONS AND DIVISION WALLS.

of additional areas in the Weiser basin was completed.

(*b*) *Land classification—Dry Creek area.*—Mapping lands in the Dry Creek area was completed.

(*c*) *Black Canyon—High lands survey.*—A survey of the Black Canyon canals is being made to determine if any of these lands might be irrigable by pumping from Black Canyon Canals.

(*d*) *Garden Valley dam sites.*—Topography on no. 1 site was completed and work was begun on no. 2 site, but discontinued when geological studies indicated that both sites probably have defective foundations. Topography was begun on a site about 3½ miles farther down the canyon where geologic conditions were more favorable.

(*e*) *Twin Springs dam site.*—Detailed survey of the Twin Springs dam site on Middle Fork of Boise River was continued.

(*f*) *Cascade reservoir site.*—Further preliminary surveys of the Cascade Reservoir site on the North Fork of Payette River are in progress. Preliminary lines showing possible relocations of railroad and highway were run.

(*g*) *Cabarton Reservoir site.*—Further data concerning the value of improvements within the flow line of the Cabarton Reservoir site were secured.

(*h*) *Vista Reservoir site.*—A preliminary survey was made of a dam and reservoir site on the Main Weiser River, near Council, Idaho.

(*i*) *Gold Fork dam site.*—A detailed survey of a dam site on Gold Fork Creek, a tributary to the North Fork of Payette River, was completed during the month.

(*j*) *Council Orchard lands—water supply.*—A survey is being conducted in quest of a supplemental water supply and a means of diversion for 2,000 acres of land, known locally as the Council Orchard lands, in the Weiser River Basin lying along the foothills east of the village of Council.

(*k*) *Possible power sites on Snake River.*—A favorable site for power development was found a short distance above the mouth of Snake Creek.

(*l*) *Boise Valley ground water map.*—Further study was made in connection with preparation of a Boise Valley ground water map.

(*m*) *Preliminary report* of the investigations is in progress.

Madison River diversion, Montana.—Altimeter topography of the irrigable land on the Madison River watershed, and land classification and topography on the Norwegian Creek were completed.

Altus project surveys, Oklahoma.—Topographic surveys of the dam site and spillway have been completed. The work of classifying the lands is advancing rapidly. Diamond drilling of the dam site is in progress.

Canby project, Oregon.—Some preliminary work on these investigations was done.

Grande Ronde, Oregon.—Survey of ground water was completed on June 10. Topographic survey of the Lower Grande Ronde reservoir site was completed except for some section ties. Dam site no. 1 is located just below the mouth of Spring Creek, along the river line, and no. 2 is located just above the confluence, approximately 750 feet from no. 1. Detailed survey of the Catherine Creek reservoir site is being made.

Black Hills, South Dakota.—(*a*) *Angostura project.*—Design of the dam and spillway has been agreed upon, the cost estimate completed, and a summary of project costs prepared. Work was continued on the designs and estimates for the proposed dam at the Horse Camp site.

(*b*) *Rapid Valley project.*—A study was made of the Deerfield Reservoir as a storage possibility for the present irrigated lands only. A design for the Deerfield Dam is now being prepared. A survey is being made of a small reservoir and dam site at Buffalo Gap, near Hot Springs.

Utah investigations.—(*a*) *Blue Bench.*—All field data pertaining to the surveys of several canals were worked up and cost estimates of the same prepared. Cost estimates of three alternate canal locations were revised and completed.

(*b*) *Dixie project.*—The canal line formerly surveyed is being inspected.

(*c*) *Salt Lake Metropolitan Water District Aqueduct.*—Report on the Salt Lake Aqueduct investigations was approved on June 18, 1937.

Colorado River Basin.—(*a*) *Irrigated area survey—Monticello, Utah.*—Mapping was continued during the month and an area of 10,240 acres was completed.

(*b*) *Lower Dolores River.*—Irrigated lands on the Lower Dolores River were mapped and small areas of undeveloped lands were classified during the month.

(*c*) *Piceance Creek, Colorado.*—Mapping of irrigated lands on Piceance Creek and its tributaries was continued and an area of 14,400 acres was completed.

(*d*) *Price, Huntington and Cottonwood Rivers, Utah.*—Mapping of irrigated lands and classification of undeveloped lands along Price River was initiated and mapping of similar areas on Huntington and Cottonwood Rivers was continued.

(*e*) *Proposed Dolores project, Colorado and Utah.*—Classification of undeveloped lands was completed.

(*f*) *San Miguel area, Colorado.*—Classification of undeveloped lands on the proposed Lilylands project was continued, and mapping of irrigated lands on the San Miguel project was continued.

Eight Thousand Miles of Reclamation

(Continued from p. 186)

velopment, and regulation of the North Platte River. Its two dams, Seminoe and Alcova, will interlock with Pathfinder and Guernsey Dams of the North Platte project in river regulation. Seminoe Dam will abut against the solid walls of Granite Canyon upstream from Pathfinder Reservoir. Alcova diversion dam, of the rolled-earth type, is rapidly replacing part of the mountain at the narrow Alcova Canyon which the river spent many years in taking away.

Within a few miles from Denver, Colo., and offering a fitting climax to the trip, is the scene of the proposed Colorado-Big Thompson transmountain diversion project (picture no. 10). With an ingenious layout of catch basins, diversion dams, tunnels, canals, power drops, and storage reservoirs, it is planned to divert water from the headwaters of the Colorado River through the Continental Divide as a supplemental supply for the rich farm lands of northeastern Colorado.

Even such a cursory visit to the projects as herein described shows the Bureau of Reclamation to be continuously pushing on to greater achievement and establishing its position as a Government agency of vital importance to the whole Nation.

Single-Blade Weed Eradicator Drawing Available

The Bureau has received so many requests for information on the single-blade weed eradicator, now being used on many Reclamation projects for root-cutting to eradicate wild morning glory, Russian knapweed, white top, and other noxious perennial weeds, that a reprint has been made of the drawing and accompanying explanation "A Weed Eradication Program" published in the February issue of the Reclamation Era.

The single-blade weed eradicator is a relatively inexpensive tool which a farmer can construct with the aid of a blacksmith. A full description of the material required for this tool is given on the drawing and detailed instructions as to its use to kill spreading perennial weeds are contained in the text.

As long as the supply lasts, reprints of the drawing no. 26236 with the article "A Weed Eradication Program" are available without charge to project superintendents, county agents, agricultural instructors, and farmers interested in building a weed eradicator.

Articles on Irrigation and Related Subjects

All-American Canal:
- Draglines rush All-American Canal work, illus., Felix Heidelburg, International Engineer, May 1937, vol. 71, no. 3, pp. 120–123.
- Final excavation in sand and rock for All-American Canal, illus., Jos. C. Coyle, Contractors and Engineers Monthly, June 1937, v. 34, no. 6, pp. 15, 42, and 43.

Bartlett Dam:
- Highest multiple arch dam under construction on Verde River in Arizona, illus., Western Cons. News, June 1937, v. 12, no. 6, pp. 204–207.

Bourne, R. F., and A. H. Davis:
- Study of the deterioration of rigid metal electrical conduit when exposed to 100 percent humid atmosphere, Tech. Memo. no. 554, May 17, 1937, 10 pages, price 25 cents.

Colden, Hon. Chas. J.:
- Unjust attacks on irrigation—Western States contribute to entire Nation, Congressional Record, May 20, 1937, vol. 81, no. 96, pp. 6379–6380.

Conkling, Harold:
- Underground water control, discussion, Proc. A. S. C. E. May, 1937, vol. 63, no. 5, pp. 911–914.

Culver, D. S.:
- Procedure for making temperature studies on exposed slabs, technical, memorandum, no. 551, May 7, 1937, 26 pages, with charts. Price $1.10.

Cummings, Homer, Attorney General:
- Identical sealed bids received by Government agencies, Extension remarks, Arthur D. Hadley, Congressional Record, June 9, 1937, v. 81, no. 109, p. 7205.

Edwards, Philip J.:
- Trial-load twist analyses of Friant Dam joints grouted. Tech. memorandum, no. 553, May 14, 1937, 19 with charts. Price $0.95.

Glendale, Calif.:
- Glendale pays ten years in advance on contract for Boulder Dam power, Southwest Builder and Contractor, June 25, 1937, v. 89, no. 26, p. 11.

Grand Coulee Dam:
- Can the Columbia be controlled, illus., The Earth Mover, June 1937, v. 24, no. 6, pp. 11–15.
- Contractors win river battle (with grout and bentonite), illus., Eng. News-Record, July 1, 1937, v. 119, pp. 13–16.
- Fortune, July 1937. Beautifully illustrated.
- Repairing cofferdam break at the Grand Coulee Dam, illus., Western Constr. News, May 1937, vol. 12, no. 5, pp. 184–185.

Haw, John W.:
- Washington-Northern Idaho. Settlement pamphlet of 56 pages, profusely illustrated, issued by Northern Pacific Railroad in Spring of 1937. (Contains description of Yakima Valley and Columbia Basin project.)

Houck, Fred A.:
- Analysis of a circular arch under uniform load, Technical Memorandum no. 550, April 29, 1937, 33 pp. Price 80 cents.

Hutchins, Wells A.:
- Mutual Irrigation Companies in California and Utah, illus., numerous tables, Farm Credit Administration, Bulletin no. 8, Oct. 1936, 235 pp.

Ickes, Hon. Harold L.:
- P. W. A. summarizes accomplishments of its 4-year construction program. The Constructor, June 1937, vol. 19, no. 6, pp. 24–25.

Imperial Dam:
- Imperial Dam project progresses rapidly, illus., Jos. C. Coyle, Contractors and Engineers Monthly, May 1937, vol. 34, no. 5, pp. 2, 40, 41, 53–56.

Larsen, R. T.:
- Spillway job at Horse Mesa Dam, illus., Southwest Builder and Contractor, July 2, 1937, vol. 90, pp. 12–15.

Lawson, L. M.:
- Rectification of the Rio Grande, illus., Civil Engineering, July19 37, vol. 7. pp. 457–461.

Marshall Ford Dam:
- Allied construction firms start work on Marshall Ford Dam, illus., Construction Methods, June 1937, vol. 19, no. 6, pp. 64–65.
- Marshall Ford Dam designed for raising in future plans, Eng. News-Record, May 13, 1937, vol. 118, p. 712.

Martin, Hon. John A.:
- Reclamation Policy—In the West irrigation water is life. Cong. Record, May 19, 1937, vol. 81, no. 95, pp. 6280–6281.

Mead, Lake:
- Passage of turbid water through Lake Mead, Discussion by Messrs. O. A. Faris, P. A. Jones, C. S. Scofield, and Ivan E. Houk, Proc. A. S. C. E., June 1937, vol. 63, no. 6, pp. 1208–1214. (Charts of temperature in Lake Mead and Elephant Butte Reservoir.)

Mexico, irrigation:
- Irrigation development in Mexico, history, projects, and results, illus., Chas. P. Williams, Western Cons. News, May 1937, vol. 12, no. 5, pp. 178–183.

Murdock, Hon. John R.:
- American or Mexican (Colorado River water). Cong. Record, May 14, 1937, vol. 81, p. 6005.
- How shall the Colorado River be further developed? Cong. Record, June 8, 1937, vol. 81, no. 108, pp. 7144–7145.
- What do you know about the Gila project? Cong. Record, May 24, 1937, vol. 81, no. 98, pp. 6512–6513.

Nebraska:
- Twenty-first Report, Bureau of Irrigation water power and drainage of the department of roads andirrigation, R. H. Willis, Chief of Bureau, pp. 269–972. (Table on p. 384 gives the irrigated area by counties; total, 710,548 acres.)

Oregon Reclamation Commission:
- Fifth biennial report, State Reclamation Commission, 1934–36. Chas E. Stricklin, Secretary, 1937, 76 pp. (Contains list and index of all irrigation districts in Oregon.)

Page, John C.:
- Water problems grow more complex day by day, Commissioner says. Address at River and Harbors Congress, Southwest Builder and Contractor, May 21, 1937, vol. 89, no. 21, pp. 14–16.

Parker Dam:
- Rapid progress on deep excavation for Parker Dam on Colorado River, illus., Southwest Builder and Contractor, June 4, 1937, vol. 89, no. 23, pp. 13–14.
- Hydraulic models used in design of Parker Dam, illus., S. Perliter, Civil Engineering, June 1937, vol. 7, no. 6, pp. 409–410.

Power Development:
- The challenge from Federal Power Developments, Geo. C. Tenney, Electrical West, June 1937, vol. 78, no. 6, p. 90. ("The West is growing in population more than twice as fast as the rest of the Nation—three times as fast as the East. People are coming from the Dust Bowl looking for farms.")

Preston, Porter J.:
- Brief biography with portrait, Colorado Engineers Bulletin, June 1937, vol. 21, no. 6, pp. 28–29.
- Report on Colorado-Big Thompson project, Feb. 3, 1937, S. Doc. 80; 75th Cong., 1st Ses., 33 pages.

Quinn, Hon. Jas. L.:
- Congress pays tribute to Secretary of the Interior Harold L. Ickes, Cong. Record, June 1, 1937, vol. 81, no. 103, pp. 6830-6831.

Roza Tunnels:
- The Roza Tunnels, illus., Walter A. Averill, Pacific Builder and Engineer, June 5, 1937, v. 43, no. 23, pp. 42-46.

Russell, Frank M.:
- Design data for gallery stresses as determined by means of plastercelite models, Tech. Memo. no. 555, June 16, 1937, 28 pp. including numerous charts, price $2.30.

Sanford, Geo. O.:
- Power development on Federal reclamation projects, Agricultural Engineering, May 1937, vol. 18, pp. 215-6.

Savage, John L.:
- Homage to an engineer, editorial on "Jack" Savage and his work. Compressed Air Magazine, May 1937, vol. 42, no. 5, p. 5331.
- The Boulder Dam, special lecture (in London) April 15, 1937, illus., Journal of the Institution of Civil Engineers, no. 7, 1936-1937, June 1937, pp. 161-180.

Schnurr, Miss Mae A.:
- Biography of Major General Edward Murphy Markham, Chief of Engineers, War Department. Explosives Engineer, June 1937.
- Biography, with portrait, of John C. Page, Commissioner of Reclamation. Explosives Engineer, July 1937, vol. 15, no. 7, pp. 196-197.

Schwellenbach, Hon. Lewis B.:
- Conservation of National Resources, Radio address. Inserted in Cong. Record by Hon. Carl A. Hatch, Cong. Record, June 1, 1937, vol. 81, no. 103, pp. 6822-24.

Stubbs, Jas. A.:
- Tri-axial elastic properties of plastercelite cubes. Technical Memorandum no. 552, May 17, 1937, 31 pages, charts and illus. Price $2.15.

Texas:
- 12th report Board of Water Engineers, Sept. 1, 1934 to Aug. 31, 1936, C. S. Clark, chairman, 56 pp.

Upstream Engineering:
- Headwaters, control and use. Papers presented at the Upstream Engineering conference, September 22 and 23, 1936, illus., 261 pages. Government Printing Office. Price 60 cents.

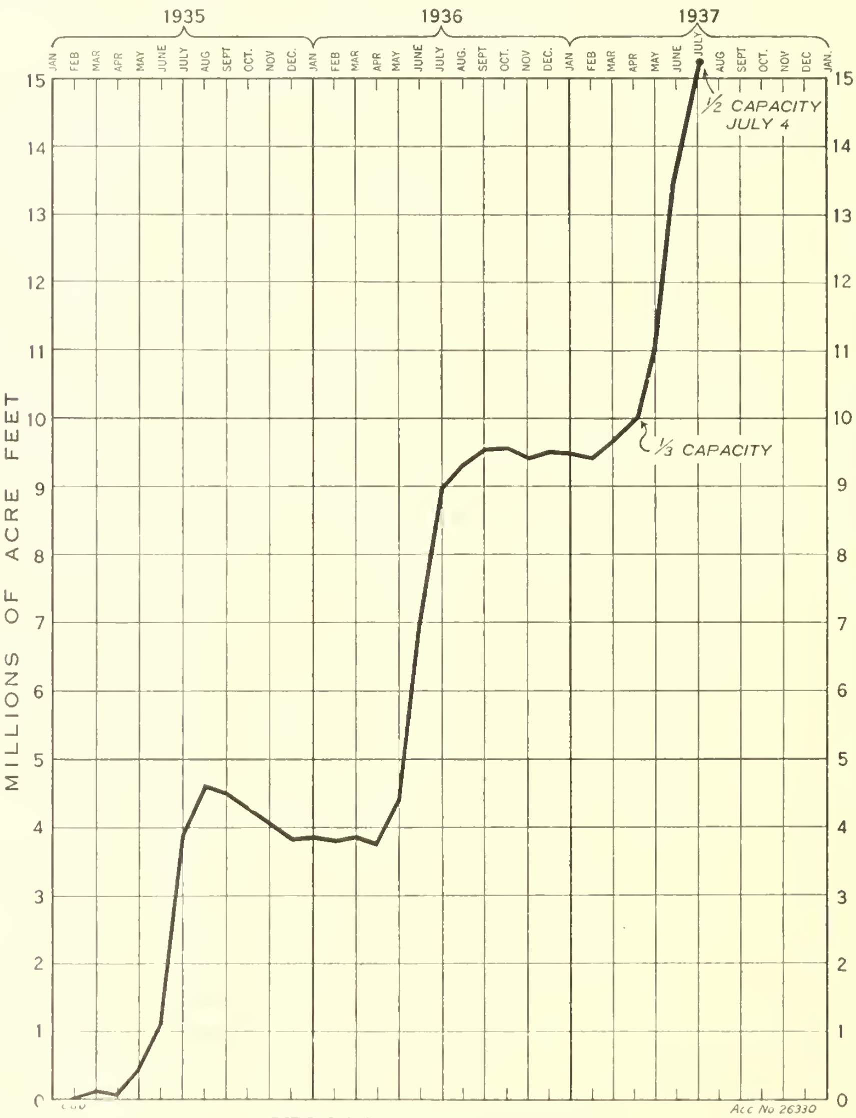
Vetter, C. P.:
- Stresses around circular holes in dams and buttresses, discussion, Proc. Am. S. C. E., May 1937, vol. 63 pp., 1013-15.

Storage in Lake Mead

Storage of water in Lake Mead began in February 1935 and reached a maximum that year on July 31, with 4,578,000 acre feet. The maximum in 1936 was on September 10, with 9,640,000 acre feet.

	Acre feet	Elevation		Acre feet	Elevation
1935			*1936*—Con.		
February	110, 000	708. 7	May	7, 076, 000	982. 45
March	84, 000	701. 7	June	8, 978, 000	1015. 50
April	402, 000	752. 7	July	9, 291, 000	1020. 45
May	1, 080, 000	806. 6	August	9, 550, 000	1024. 45
June	3, 875, 000	910. 0	September	9, 559, 000	1024. 60
July	4, 578, 000	928. 45	October	9, 426, 000	1022. 55
August	4, 489, 000	925. 9	November	9, 491, 000	1023. 55
September	4, 284, 000	920. 75	December	9, 481, 000	1023. 35
October	4, 055, 000	914. 9	*1937*		
November	3, 805, 000	908. 3	January	9, 402, 000	1022. 25
December	3, 810, 000	908. 4	February	9, 661, 000	1026. 15
1936			March	9, 984, 000	1031. 00
January	3, 790, 000	907. 9	April	10, 929, 000	1044. 55
February	3, 810, 000	908. 4	May	13, 582, 000	1078. 71
March	3, 734, 000	906. 9	June	15, 121, 000	1096. 53
April	4, 343, 000	922. 25	July 4	15, 250, 000	1097. 88

On July 4, 1937, water in Lake Mead was about 450 feet deep, and the lake extended to a distance of 108 miles.



STORAGE IN LAKE MEAD
BEGINNING OF OPERATIONS FEBRUARY 1935. TO DATE

Reclamation Organization Activities and Project Visitors

R. F. Walter, chief engineer, visited the Ogden River and Provo River projects in Utah on June 29. At Ogden River Mr. Walter made an inspection trip to the Pine View Dam, and at Provo River he discussed various features incident to the Deer Creek division. Mr. Walter was on the Boulder Canyon project on June 30.

On recommendation of Commissioner Page, the Secretary of the Interior has approved the transfer and promotion of Roy B. Williams, construction engineer, All-American Canal project, Yuma, Ariz., to the Washington office, where he will take over the duties of the new position of Assistant Commissioner. Mr. Williams has been in the Bureau since 1913 in various responsible engineering assignments.

Leo J. Foster, construction engineer, Humboldt project, Reno, Nev., has been transferred to the All-American Canal and Gila projects, with headquarters at Yuma, Ariz. Mr. Foster succeeds R. B. Williams as construction engineer.

Wesley R. Nelson, associate engineer, Boulder Canyon project, was transferred to the Washington office on April 6, 1936. Effective June 28, 1937, Mr. Nelson was promoted to the position of Chief of the Engineering Division, Washington office, to fill the vacancy left by the appointment of John C. Page, as Commissioner of Reclamation on January 25 last.

John S. Martin, Chief Clerk of the C. C. C division, Washington office, has been appointed through civil-service reinstatement to the Pine River project as chief clerk Mr. Martin was formerly employed on the Boise, Minidoka, and Grand Valley projects, resigning from the Government service to go with the Minidoka irrigation district. After 4 years with that organization he was engaged in private business until reemployed by the Bureau on emergency work in the Washington office November 1933.

L. H. Mitchell, field supervisor of Operation and Maintenance, spent several days during June on the Uncompahgre project. Mr. Mitchell also visited the Provo River project and discussed with the officials, matters pertaining to weed control.

Louis R. Douglas, recently appointed safety engineer of the Bureau of Reclamation, spent the week beginning July 18 in the Washington office working out the details of an accident-prevention program which will shortly be started on all projects. Mr. Douglas is planning to visit all projects for the purpose of acquainting supervisory officials with the program, the report to be made, and methods to be followed in bringing about a reduction of lost-time accidents.

S. E. Rockwell, engineer from the Denver office, spent several days during June on the Milk River project.

S. O. Harper, assistant chief engineer, and F. F. Smith, engineer, inspected McMillan and Avalon Dams on the Carlsbad project during June.

E. R. Mills, chief clerk, Central Valley project, accompanied by C. A. Lyman, field representative, paid a short visit to the Orland project the latter part of June.

Walter S. Ball, field supervisor of weed control, State of California, was on the Klamath project on June 27, when he inspected weed conditions on the Tule Lake division.

T. R. Smith, construction engineer for the Prosser power plant and the Kennett division, Yakima project, and now employed on the Central Valley project, was in the Yakima project office on June 30.

Charles S. Hale, engineer with headquarters at Reno, Nev., has been designated by Commissioner Page as acting construction engineer of Truckee River storage project, following the transfer of L. J. Foster to the All-American Canal project.

The following appointments were authorized during the month of June by the Secretary of the Interior:

Washington office:
- Charles Mann, junior clerk, Engineering division, vice Jacob S. Matlack, resigned.

Denver office:
- Luke E. Allen, junior clerk, vice Emmett E. Rowell, resigned.

Denver office—Continued.
- Milton James Evans, junior engineer, vice Dolph Campbell, resigned. Mr. Evans was transferred from the Bureau of Standards, Department of Commerce, Riverside, Calif.
- Sherman O. Gaskin, messenger.
- Carey R. Hughes, engineering draftsman (was formerly in General Land Office at Denver).
- Benjamin E. McCown, associate engineer.
- Alfred F. Sigwalt, junior engineer, by transfer from the U. S. Engineer Office, War Department, Milwaukee, Wis.

Milk River project:
- Miss Mineola L. Fenter, junior clerk, vice Lillian Hornick.

Shoshone project:
- Mrs. Dorothy Furlong, junior clerk.

Central Valley project:
- Joseph J. Cullinan, chief of field party.

Columbia Basin project:
- Glendon A. Mack, assistant clerk.
- Frank L. Maynard, supervisor of Labor Relations.
- Charles C. Parsons, assistant supervisor of Labor Relations.

Yakima project:
- Albert F. Chittenden, inspector, Roza division.

The following transfers were authorized during the month of June by the Secretary of the Interior:

To Denver:
- Frank C. Merriell, engineer, from Grand Junction, Colo., to the Western Slope Surveys.
- Grover R. Filler, laboratory aide, from Fort Collins, Colo.
- Marvin R. Spindler, junior engineer, from laboratory aide, Fort Collins, Colo., vice Irwin M. Smith, resigned.
- J. Edwin Hall, assistant clerk, from Ogden, Utah.
- George Tartleton, assistant engineer, from Parker Dam, Calif.
- Harold W. Mutch, associate engineer, from the Conchas Surveys, Tucumcari, N. Mex.

From Denver:
- Louis L. Ruhlen, inspector, to the All-American Canal project, Yuma, Ariz.

To Fresno Dam, Milk River project:
- James A. Callen, assistant engineer, from Ogden, Utah.
- John H. Gibson, inspector, from Ogden, Utah.

To Colorado River project, Texas:
- Homer H. Mills, inspector, from Boulder Canyon project.

The following resignations have been accepted by the Secretary of the Interior:

Denver office:

- Marvin V. Maxwell, associate engineer, to accept offer with the Westinghouse Electric & Mfg. Co., Detroit, Mich.
- Robert W. Newsom, assistant engineering draftsman, to accept employment with the Shell Oil Co., Martinez, Calif.
- William J. Farrell, junior engineer, to enter into private work with his brother in West Palm Beach, Fla.
- Leonard A. Brickham, junior engineer, to go with the Utah Copper Co., Salt Lake City, Utah.

Miss Inez C. Mahoney, clerk, All-American Canal project, was recently married and the records were changed, effective May 19, to show her name as Mrs. Inez C. Randall.

Homer D. Graham, formerly superintendent of C. C. C. Camp BR–23, at Montrose, Colo., on the Uncompahgre project has been appointed administrative inspector, with headquarters at Denver, for the C. C. C. camps assigned to the Bureau of Reclamation. Mr. Graham has been associated with C. C. C. camps since July 1933, the past 2 years being in charge of the Montrose camp. In addition to his C. C. C. training, Mr. Graham is well qualified for his new position, having had many years of experience as county engineer for Delta County and city engineer for Delta, Colo., in addition to an extended construction experience.

Louis S. Davis, engineer, C. C. C., and Homer D. Graham, administrative inspector, C. C. C., of the Denver office were in Washington on official business for a week beginning July 14.

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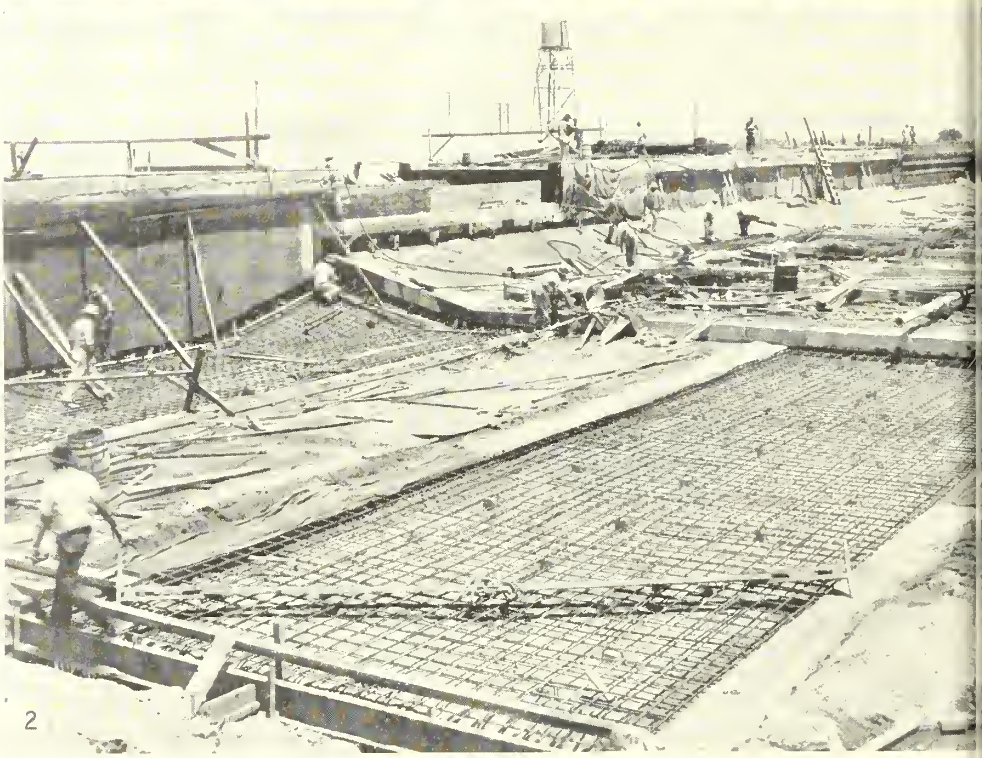

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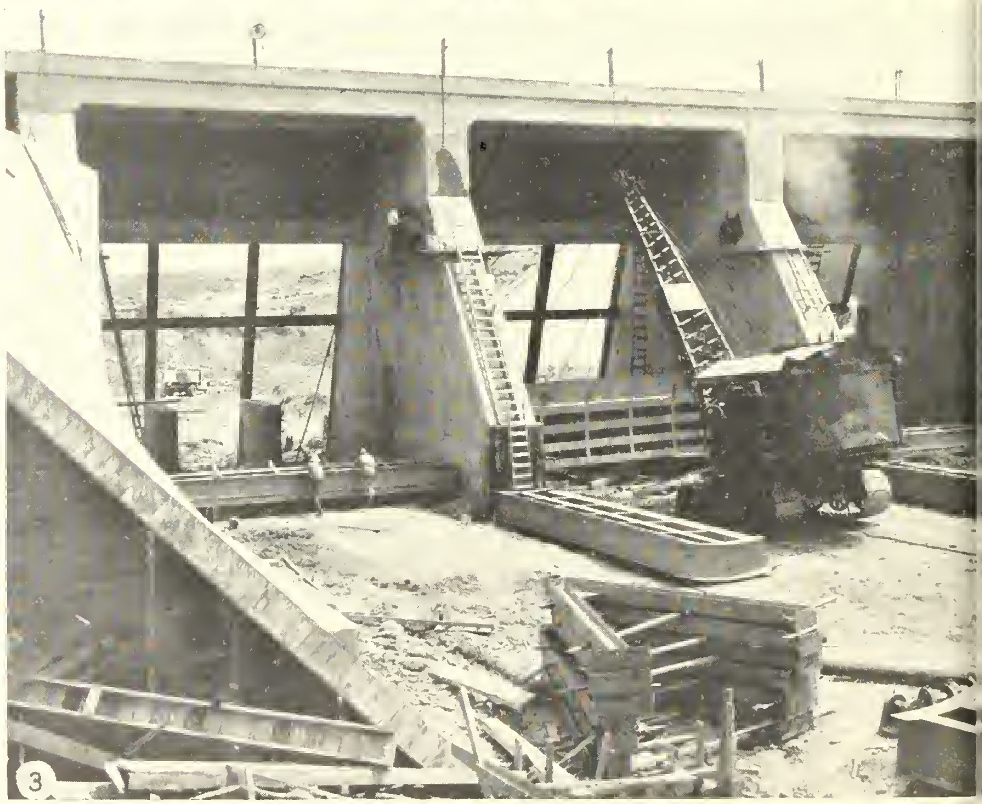

ALL-AMERICAN CANAL PROJECT, ARIZONA–CALIFORNIA.

1. EXCAVATION ON CANAL ABOUT 5 MILES BELOW IMPERIAL DAM. THIS CANAL HAS A BOTTOM WIDTH OF 160 FEET AND A CAPACITY OF 15,000 SECOND FEET.
2. LAYING REINFORCEMENT FOR FLOOR SLAB OF INLET TO PICACHO WASH SIPHON.
3. RADIAL GATE STRUCTURE NO. 3, GILA HEADWORKS, IMPERIAL DAM.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

THEODORE A. WALTERS, FIRST ASSISTANT SECRETARY, in charge of reclamation

John C. Page, Commissioner **Roy B. Williams**, Assistant Commissioner

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr.; Wesley R. Nelson, Chief, Engineering Division; P. I. Taylor: Assistant Chief; A. R. Golzé, Supervising Engineer, C. C. C. Division; William F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief, Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, C. C. C. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz.	Leo J. Foster	Constr. engr.	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev.	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Fort Sumner, N. Mex.	Wilfred W. Baker	Constr. engr.		do	Do.
Casper Alcova	Casper, Wyo.	H. W. Bashore	do	C. M. Voyen	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex
Columbia Basin	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Frenchtown, Mont.				W. J. Burke	Billings, Mont.
Gila	Yuma, Ariz.	Leo J. Foster	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev.	Stanley R. Marean	Resident engr.[2]	George B. Snow	do	Do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont.	H. V. Hubbell	Constr. engr.	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Superintendent	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do	George W. Lyle	R. J. Coffey	Los Angeles, Calif.
Pine River (Vallecito Dam)	Bayfield, Colo.	Charles A. Burns	do	John S. Martin	J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex.	L. R. Fiock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	S. F. Crecelius	Constr. engr.	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Bull Lake Damsite	Riverton, Wyo.	Arthur P. Smyth	Resident engr.		do	Do.
Salt River	Phoenix, Ariz.	E. C. Koppen	Constr. engr.	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont.	A. W. Walker	Superintendent		do	Do.
Truckee River Storage	Reno, Nev.	Charles S. Hale	Constr. engr.[2]	George B. Snow	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do	do	Do.
Upper Snake River Storage [3]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash.	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza division	do	Charles E. Crownover	Constr. engr.	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting [3] Island Park and Grassy Lake Dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M. Watson	Caldwell.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	C. W. Tharp	do	C. J. McCormich	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. U. A.	Hyrum, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly	Horsefly irrigation district	do	Henry Schmor, Jr.	President	Dorothy Eyers	Do
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook division [1]	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division	Gering-Fort Laramie irrigation district	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do	Mary E. Harrach	Torrington.
Northport division	Northport irrigation district	Northport, Nebr.	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do	D. D. Harris	Layton.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland division	Shoshone irrigation district	Powell, Wyo.	M. P. McLaughlin	Irri. superintendent	Geo. W. Atkins	Powell.
Frannie division	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Superintendent	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	S. W. Grotegut	Manager	E. G. Breeze	Payson.
Sun River: Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	do	E. J. Gregory	Fort Shaw.
Greenfields division	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West division	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose.
Yakima, Kittitas division	Kittitas reclamation district	Ellensburg, Wash.	V. W. Russell	Manager	G. L. Sterling	Ellensburg.

[1] Operated by 5 irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer
Colorado-Big Thompson	Denver, Colo.	Mills E. Bunger	Engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	Do.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo.	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo.	Frank C. Merriell	Do
Black Hills	Denver, Colo.	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	do	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do.
Conchas	Tucumcari, N. Mex.	J. A. Keimig	Associate Engineer.
Grande Ronde	La Grande, Oreg.	C. C. Fisher	Engineer.

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LAKE MEAD

THE

RECLAMATION ERA

SEPTEMBER 1937

HIGHLIGHTS OF CONGRESSIONAL ACTION

The close of the first session of the Seventy-fifth Congress passed appropriations totaling $41,586,600, which permit the Bureau to continue its large construction program in 14 Western States.

One new project was authorized in Colorado and funds appropriated to commence construction of the Colorado-Big Thompson project.

Congress also authorized the setting up of a commission to be composed of three members appointed by the Secretary of the Interior, all members to possess an intimate knowledge of irrigation farming and have no financial interest in the matters coming under their jurisdiction. Employees of the Bureau of Reclamation are disqualified. The commission will investigate the financial, economic, and other conditions affecting the ability to pay by water users on Federal reclamation projects under their repayment contracts with the Government. The Bureau welcomes this review and hopes that a competent commission will make a sincere effort to solve the problems which lead to requests for moratoria and contract adjustments.

The commission is instructed to make recommendations to Congress as to the best, most feasible and practicable comprehensive permanent plan based on the ability of water users to meet water-right charges regularly and fully from year to year during periods of prosperity and good prices for agricultural products, as well as during periods of decline in agricultural income and unsatisfactory conditions of agriculture. The commission will also determine what payments should be required on amounts becoming due in 1937.

A special act passed by the Seventy-fifth Congress authorized an appropriation of $500,000 from the reclamation fund for small storage reservoirs to be located within the States subject to the Federal Reclamation Act as the Secretary of the Interior may select, the cost of any one storage not to exceed $50,000. The appropriation was not made and therefore work under the authorization is delayed until funds can be secured during the next session of Congress, convening in January 1938. The Bureau will take the initiative in asking for these funds.

We have every reason to be thankful for the fine cooperation of the administration and Congress in furnishing sufficient funds to carry on our reclamation program.

JOHN C. PAGE, *Commissioner.*

THE

RECLAMATION ERA

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The Relationship Between the Bureau of Reclamation and Its Water Users

By John C. Page, Commissioner of Reclamation [1]

THE future of the Federal reclamation policy rests with the project water users. In the end, the attitude of the farmers served by the irrigation systems built by the United States will be accepted as the criterion of the success of this work.

The Bureau of Reclamation may take pride in the work it has done. It has built well. In very few instances has its planning been faulty. It has created homes in what once was the desert for 840,000 people, who have built up in these sparsely settled Western States strong, progressive, and prosperous American communities.

Our purpose is to create opportunities for diligent men and women to make homes and to give them a chance by their own efforts to win for themselves a fair share of the necessities and luxuries of life. This purpose, of course, is not served alone by placing concrete and steel in a dam. There is human engineering beyond this.

Generally, our project people have been prosperous, although agriculture under irrigation is subject to the same depressive influences which operated in rural and in urban areas everywhere a few years ago. Last year the crop returns from Federal projects totaled $136,502,480, or an average of $47.10 per acre. Last year and for the years before that, through the depression and beyond, the farmers on Federal projects received a per acre crop return about two and one-half times that received on the average by all the farmers in the United States. In addition to this evidence, the excellent record made by project water users in the repayment of their construction costs is significant as an index to the general well-being of the project people. Ninety-nine percent of all the money which has become due and payable under repayment contracts has been collected by the Bureau of Reclamation.

A total of $48,268,782.16 has become due and payable from the projects under their contracts for repayment of the construction costs of their irrigation works, and $47,562,012.45 has been repaid. To date $31,581,702.14 has become due and payable on charges for operation and maintenance, and $31,352,023.70 has been paid. Water rental charges to date have amounted to $9,953,628.17, and $9,877,528.46 has been paid.

Water users of all participating projects should be proud of their records. They are records of obligations solemnly accepted which should be scrupulously met.

There is none who understands better than I that inequities may exist in the repayment structures of the various projects under the present legal requirement for repayment periods of equal length. I know that in times of severe localized drought some areas may suffer, or that other conditions may conspire to make oppressive inflexible contracts that might have been justly considered liberal at the time of their execution.

There is no disposition anywhere, and certainly not in the Bureau of Reclamation to turn Uncle Sam into an Uncle Shylock, determined to take his pound of flesh, where these contracts are concerned.

COMMISSION APPOINTED

The Bureau and the Department of Interior this year supported, the Congress passed, and President Roosevelt approved two bills, one to set up a commission to study the repayment system of the Bureau of Reclamation in an effort to find a better method, and the second appropriating $30,000 to finance the investigation and the preparation of a report to the Congress next year. In addition, the Commission has authority to recommend to the Secretary of Interior the curtailment or suspension of repayments due for 1937 from projects where this action is warranted by present conditions.

All of us who are charged with the administration of the Federal reclamation laws join wholeheartedly with you in hoping that this Commission will be able to devise a plan for repayment of construction costs which will prevent injustices, inequities, and oppressive charges wherever they exist.

This Commission will be set up shortly. Secretary Harold L. Ickes, of the Department of Interior, now is considering names of those eligible to serve. The Secretary, you may be sure, is making an honest effort to obtain outstanding men, with thorough understanding of irrigation and its problems, in whom you and the whole country may have confidence, and whose findings will carry weight in the Congress.

This Commission, however, cannot work a miracle. Its report will not bring the millenium. It can do no more than it is assigned by the law to do. I doubt whether it will be able to please everybody. It is not empowered to recommend that any obligations or any part of any obligation be written off the books. It can, and I trust it will, arrive at an intelligent, workable, fair, and equitable method of collecting repayment charges which will meet with the approval of the overwhelming number of project water users.

I will say with all frankness that I hope the Commission will be able to devise a repayment method which will do away for all time with the necessity of and agitation for blanket moratoria on project repayments. Moratoria in which all projects share, and share alike, regardless of the need for relief or the financial conditions prevailing among project water users when continued beyond the emergency for which they were devised, threaten the very foundation of the Federal recla-

[1] Address delivered in Caldwell, Idaho, Sept. 15, 1937, before the Federal Irrigation Congress.

mation policy. I am opposed to them, as should be all of us who are interested in continuation of the Federal reclamation program.

When the Federal reclamation policy was adopted with the act of June 17, 1902, it was designed as a means of assisting the Western States to help themselves. Money obtained from the sale of public lands in these Western States and from similar sources, all western, was put in a special fund, the reclamation fund, for use in development of the West through construction by the Federal Government of irrigation projects. The reclamation fund is a revolving fund. The cost of the projects built with money from this fund is repaid by those benefiting and the repayments go back into the fund.

CONTINUANCE OF RECLAMATION NECESSITATES REPAYMENTS

The fundamental principle upon which the policy was founded was that those who benefit should repay the cost of their projects, without interest, in order that the benefits could be spread through new construction to others. This principle is the unchanging foundation rock upon which the Federal reclamation policy is erected. All that the West owes to Federal reclamation in the way of growth and development is a result of this. All the promise that a continuation of the Federal reclamation policy holds for the future of these arid and semiarid States is no more secure than the integrity of the repayment principle. Anything which tends to cut away this foundation, as do indiscriminate and blanket moratoria, threatens the whole reclamation structure.

The principle is fundamentally American and fundamentally sound.

It is for that reason that I oppose blanket moratoria and favor more discriminating relief for projects which are in need. It is for that reason that I call upon you and the water users of all Federal reclamation projects to do likewise.

Federal reclamation has not yet served its complete purpose. From every part of the West come pleas for new projects or new storage reservoirs. The long drought which began in 1929, and has affected all or parts of the West in varying degrees ever since, has emphasized the need for additional irrigation development in this western third of our country.

In addition to the vagaries of the weather, there are other factors at work which add weight to the argument for additional reclamation construction. Many projects, whether originally constructed by the Federal Government or by cooperative or individual effort, are in need of additional water storage. This does not result altogether by reason of the drought, which is unprecedented, at least in modern times, nor does it result from poor planning originally in connection with the construction of the projects.

The need for a larger reserve water supply stems from the very growth and development of the West which irrigation has fostered. It has been necessary in order to feed the West's growing population to farm more intensively in these irrigated areas to which western farming is confined. The old type of crop has given way to new crops, which bring larger per-acre yields and greater returns to the farmers. But these new crops require more water. Where pasture or wheat required only one or two irrigations, potatoes, fruits, vegetables, and beets require more.

Obviously this means that some of the old projects must have new reservoirs to serve their water users under the new conditions. Where can these projects look for the new construction? I will tell you where they do look. They look to the Bureau of Reclamation to provide the new dams and new reservoirs, and the Bureau must rely upon the reclamation revolving fund for the money.

Since it was set up, the reclamation fund has received a total of $281,469,504.56. The two principal sources of this money have been repayments and sale of public lands, which have contributed more than 112 millions of dollars each. But the revenue to the fund from the sale of public lands has been decreasing since 1908, and several years past this revenue has been negligible. It has dropped from $9,430,573.98 to $127,176.17. There is no chance now for this revenue to increase. There will be no important sales of public lands in the future.

The reclamation fund is left without its most important source of revenue. It is left with only one reliable and important source of revenue, and that is repayment of construction costs of projects in operation.

It is true that during the emergency Public Works Administration and Emergency Relief Administration money was allotted for Federal reclamation construction without regard to the reclamation fund. It is also true that three very large projects were undertaken and are being continued independent of the fund, namely, the Grand Coulee, Columbia Basin project in Washington,; the Central Valley project in California; and the Boulder Dam, All-American Canal project, in the Southwest.

The Congress, however, has displayed no inclination to relieve the fund of the other construction. When money has been needed to complete other projects, smaller than these, which were started with emergency money, it has been appropriated from the reclamation fund. All new projects started since these allotments have ceased, have been started by appropriations from the reclamation fund. At the close of this fiscal year the reclamation fund will be depleted. This fund next year will be unable to carry a program of the size of that now in progress, unless new revenues are found for the fund, through loan from the General Treasury or otherwise.

ALL RECLAMATION PROJECTS MUST REPAY IN FULL

It is important that everyone note that despite the fact that some Federal reclamation projects were constructed with allotments from emergency funds, and that three projects are under construction with appropriations from the general fund of the Treasury, every Federal reclamation project is expected to repay in full the cost of its construction. There is no difference in this regard between a project constructed from the reclamation fund and one for which allotments were made. I believe that the only type of project undertaken by allotment from the Public Works Administration and the Emergency Relief Administration which is expected to repay in full the entire amount, are the reclamation projects. It might be said that this fact makes the Federal reclamation projects a preferred class.

In any event, it clearly illustrates the fact that the strongest argument the West has in favor of its development by reclamation of arid lands and conservation of its meager water supply, so far as the remainder of the country is concerned, is that the money invested in these projects will be returned to the United States. There may be arguments which would be more potent in the eyes of the sociologist, the planner, the man interested in national defense, or others, but to the easterner or the taxpayer there is none.

I am confident that the Federal Government will continue to build reclamation projects just so long as it can be said honestly that there is reasonable expectation that the projects will repay their costs. Repudiation of repayment contracts by water users would be fatal, and continued agitation for moratoria in instances where they are not clearly justified would be a staggering blow.

The Bureau of Reclamation needs an organization of its water users which can serve as a clearing house for their problems, and speak authoritatively in their behalf. This organization should not serve the selfish interest of any group or speak the will of any organized minority. It should be truly representative. It could furnish us guidance and advice, help us to avoid mistakes, and make a real contribution toward better understanding.

The project water users should consider the embarrassing situation in which they would place their Congressmen and the Bureau of Reclamation if they should urge construction of supplemental storage reservoirs, which mean added investment by the United States, and request simul-

(Continued on p. 201)

Foundation Explorations Completed for Central Valley

RIGGING AND CALYX DRILLING EQUIPMENT USED TO EXPLORE FOUNDATION OF FRIANT DAM SITE. RIGHT—ONE OF THE BIG BITS WHICH CUT INTO THE UNDERGROUND ROCK TO PRODUCE 3-FOOT DIAMETER HOLES AND CORES FOR GEOLOGICAL STUDY.

Foundation exploratory work preliminary to construction of the two big dams of the Central Valley project has been completed. Almost 6 miles of tunnels, shafts, and drill holes were driven to determine the adequacy of foundation rock at six proposed dam sites.

The sites selected near Kennett on the Sacramento River above Redding and at Friant on the San Joaquin River northeast of Fresno have definitely been proven sound. Other sites explored were three near Table Mountain on the Sacramento River above Red Bluff and one at Baird on the Pit River east of Kennett.

Solid rock has been reached in all of the holes at Kennett and Friant, careful geological studies made of the cores brought to the surface, and information sent to Chief Engineer R. F. Walter of the Bureau of Reclamation in Denver, Colo., for completion of final dam designs.

Total penetration of holes on the four sites was 30,708 feet of which more than half, or 16,089 feet, was driven at Kennett. Drill cores varied from an inch and a half size produced by the diamond drills to 3-foot diameter masses brought up by the big calyx drills.

There were 227 separate tests made, including 159 drill holes, totaling 21,175 feet; 42 shafts or pits, totaling 1,856 feet in depth; and 26 tunnels and drifts, totaling 7,677 feet in length. The deepest hole was at Table Mountain where in one instance the drillers had to penetrate 355 feet to prove solid rock.

SOME OF THE 3-FOOT DIAMETER CORES OF ROCK TAKEN OUT OF THE EARTH AT SHASTA AND FRIANT DAM SITES. THESE CORES AND HOLES, PRODUCED BY LARGE CALYX DRILLS, PROVIDE GEOLOGISTS AN OPPORTUNITY TO DETERMINE THE ADEQUACY OF THE FOUNDATION ROCK.

Table showing exploration of proposed Central Valley project dam sites by Bureau of Reclamation, done both by contract and Government forces, 1936 and 1937

Type of exploration	Kennett (selected)	Baird	Table Mountain (3 sites)	Friant (selected)	Total
	Feet	*Feet*	*Feet*	*Feet*	*Feet*
Tunnels	5,487	456	[1] 711	1,023	7,677
Shafts	181	255	1,128	292	1,856
Diamond drill	10,234	3,191	3,613	3,557	20,595
Calyx drill	187	None	None	393	580
Total	16,089	3,902	5,452	5,265	30,708

[1] Includes 145 feet of drifts from shafts.

Holes of all types total 227, including 26 tunnels and drifts, 42 shafts or pits, and 159 drill holes of which 84 are at Kennett, 37 at Friant, 21 at Baird, and 17 at Table Mountain.

DURING the month of July, 65,883 persons traveling in 21,094 cars were checked through the two checking stations operated by the Natoinal Park Service on the Boulder Canyon project. Fifty thousand nine hundred and eighty-three persons entered the Nevada gate, and 14,900 passed through the Arizona gate. During the month 20,296 persons in 5,698 cars were checked through the Lake Mead station. Five hundred and twenty-five persons visited the Overton and Pierce Ferry districts.

LABOR conditions on the Carlsbad project were good throughout the month of July. All labor desiring employment was employed either on the farms or in the potash industries.

New Appointments in the Bureau of Reclamation

Upper: ROY B. WILLIAMS, Assistant Commissioner

Lower left: J. KENNARD CHEADLE, Chief Counsel and Assistant to the Commissioner **Lower right: WESLEY R. NELSON, Chief, Engineering Division**

Roy B. Williams

ROY B. WILLIAMS, former construction engineer in charge of the All-American Canal and Gila projects, in southern California and Arizona, was appointed on August 9 to the position of Assistant Commissioner of Reclamation. Mr. Williams was born in Beattyville, Ky., but moved with his parents to Montana when he was 10 years of age. He was graduated with degree B. S. in civil engineering from Montana State College in 1911.

His first assignment with the Bureau of Reclamation was in July 1912, when he was employed as surveyman and instrumentman on the Flathead project, Montana. Later assignments carried him to the St. Mary's storage and Sun River projects in Montana, the Kittitas project in Washington, Boulder Dam, and the All-American Canal and Gila projects in Arizona and California.

Mr. Williams' assignments in the Bureau have led him successively from the position of instrumentman and surveyman through the various steps to the position of senior engineer and construction engineer, and his experience as resident and construction engineer on the Kittitas division, Yakima project, Washington; as engineer during the construction of Boulder Dam; and as construction engineer in charge of the All-American Canal and Gila projects, have fitted him well for the position to which he has now been assigned as Assistant Commissioner of the Bureau of Reclamation in Washington.

J. Kennard Cheadle

J. KENNARD CHEADLE, Chief Counsel and Assistant to the Commissioner of Reclamation, was born at Frankfort, Ind., February 9, 1905. He spent 6 years at the University of Chicago, from which he holds the degrees of Ph.B., received in 1927 and J.D., received in 1929. In 1927 he entered the law school of the University of Washington, from which he returned to the University of Chicago, where he completed his course in 1929. Mr. Cheadle graduated from Harvard University in 1930 with the degree of L.L.M.

Mr. Cheadle spent 3 years in the University of Washington as assistant professor of law, and was appointed to the position of Assistant Solicitor for the Department of the Interior on October 2, 1933. In this position he handled litigation and many legal cases involving reclamation matters. He resigned from the Government on September 15, 1935, to accept a research fellowship at Harvard Law School, for the purpose of doing research work on administrative and constitutional law problems. During the past year Mr. Cheadle has been holder of the Chester Adgate Congdon professorship of public law in Syracuse University College of Law.

With a background of legal education and practice, Mr. Cheadle is appointed as a legal resident of Seattle, Wash., and enters upon the duties of Chief Counsel and Assistant to the Commissioner of Reclamation well equipped to handle the present and increasing problems with which the Bureau is confronted.

Wesley P. Nelson

WESLEY R. NELSON, new Chief of the Engineering Division, was born on a cattle ranch in southwestern Colorado near Norwood, on November 21, 1897, of W. H. Nelson, from the Shenandoah Valley of Virginia, and Susan Minor Nelson of Chillicothe, Mo. After selling his cattle interests, his father engaged in the construction of an irrigation system to carry water a distance of about 35 miles from the San Juan Mountains onto lands near Norwood and Redvale, Colo.

Mr. Nelson received a grade and high school education in Norwood, Colo., spending his summers "on the ditch." He attended the University of Colorado, 1915–17 and the University of Southern California, 1917–18. He enlisted in the United States Army, July 1918, and was honorably discharged, February 1919, with the rank of second lieutenant, Field Artillery Reserve Corps. He was in camp at the Presidio, San Francisco, Calif., and at Zachary Taylor, Ky.

From 1919 to 1922 Mr. Nelson was engaged with his father in running a cattle ranch in southwestern Colorado. He entered the service of the Bureau of Reclamation in November 1922, and worked on the Orchard Mesa and Grand Valley projects, in Colorado, under Mr. Harper, and Mr. Page until June 1926 in the positions of rodman, levelman, instrumentman, chief of party and junior engineer. He married Miss Etta Lou Bennett of Delta, Colo., in 1923.

Mr. Nelson returned to the University of Southern California in 1926, to complete his studies in civil engineering, graduating in June 1927, with degree of B. S. in civil engineering. He is a member of Kappa Sigma, social fraternity, Sigma Phi Delta engineering professional fraternity, and Phi Kappa Phi and Chi Epsilon, honorary fraternities. He worked in the positions of surveyor, field engineer, and chief engineer for the Radiore Co. of Los Angeles, Calif., 1927–30. This company was engaged in geophysical prospecting, using electrical methods for the determination of geological subsurface conditions.

Returning to the Bureau of Reclamation in 1931, Mr. Nelson was employed on the Boulder Canyon project, at Boulder Dam in the positions of assistant engineer and associate engineer under Walker R. Young and John C. Page. He was transferred to the Washington office as engineer in April 1936 and appointed Chief, Engineering Division, June 1937. He is now Secretary of Committee D–18 on Soils for Engineering Purposes of American Society for Testing Materials, and Secretary of Interior Department Recreation Association.

It will be seen that by early training, education, and subsequent experience in the Bureau of Reclamation, Mr. Nelson is well qualified for his new duties and responsibilities in the Bureau.

A RECENT news item announces the construction some time this fall of a highway 10 miles long from the end of the present pavement south of Overton, Nev., to the boat landing on Lake Mead.

The Bureau of Reclamation and Its Water Users

(Continued from p. 198)

taneously suspension of repayments on previous expenditures.

Federal reclamation has its carping critics who can turn all statistics into deficits and who can paint word pictures of any irrigated farm in which its green fields appear more barren than the desert from which it was so arduously carved. These would be as happy as a pup with its teeth in a rag doll to discover a real argument to take the place of the straw men with which they disport themselves.

Personally, I would be willing to give to any man the right to say whether the Federal reclamation program has been valuable to the Nation and whether it should be continued, if he could but have a vision of what this area around Caldwell and Boise, or that around Phoenix, Ariz., or Yakima, Wash., for example, would be without irrigation.

The social and economic creations of the people who have irrigated the deserts in these Western States, the bent of these people for cooperation and teamwork, the homes they have made, the rural communities and the cities they have built from nothing, and the wealth they have generated, all are convincing arguments and each represents an asset to the Nation of immeasurable importance.

Reclamation Association to Meet October 12–13

Fourteen Western States will be represented at the annual meeting of the National Reclamation Association in Casper, Wyo., October 12–13. At the 2-day conference problems dealing with western reclamation and irrigation legislation will be discussed.

The States to be represented are Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, Washington, and Wyoming. O. S. Warden, of Great Falls, Mont., is president, and Charles B. Stafford, of Cheyenne, Wyo., national director of the association.

IN 1936 nearly half the cantaloup acreage in Imperial Valley, California, was planted with Powdery Mildew Resistant Cantaloup.

THE Boulder City trailer camp, constructed and to be operated by the Bureau of Reclamation, was put into operation during July, although it has not been completed.

Appropriations for the Bureau of Reclamation for the Fiscal Year 1938

(*Public No. 249—75 Cong.*)

The following is quoted from the act making appropriations for the Department of the Interior for the fiscal year ending June 30, 1938, and for other purposes:

"Administrative provisions and limitations: For all expenditures authorized by the Act of June 17, 1902, and Acts amendatory thereof or supplementary thereto, known as the reclamation law, and all other Acts under which expenditures from said fund are authorized, including not to exceed \$100,000 for personal services and \$15,000 for other expenses in the office of the chief engineer, \$20,000 for telegraph, telephone, and other communication service, \$5,000 for photographing and making photographic prints, \$41,250 for personal services, and \$7,500 for other expenses in the field legal offices; examination of estimates for appropriations in the field; refunds of over-collections and deposits for other purposes; not to exceed \$15,000 for lithographing, engraving, printing, and binding; purchase of ice; purchase of rubber boots for official use by employees; maintenance and operation of horse-drawn and motor-propelled passenger vehicles; not to exceed \$20,000 for purchase and exchange of horse-drawn and motor-propelled passenger-carrying vehicles; packing, crating, and transportation (including drayage) of personal effects of employees upon permanent change of station, under regulations to be prescribed by the Secretary of the Interior; payment of damages caused to the owners of lands or other private property of any kind by reason of the operations of the United States, its officers or employees, in the survey, construction, operation, or maintenance of irrigation works, and which may be compromised by agreement between the claimant and the Secretary of the Interior, or such officers as he may designate; payment for official telephone service in the field hereafter incurred in case of official telephones installed in private houses when authorized under regulations established by the Secretary of the Interior; not to exceed \$1,000 for expenses, except membership fees, of attendance, when authorized by the Secretary, upon meetings of technical and professional societies required in connection with official work of the Bureau; payment of rewards, when specifically authorized by the Secretary of the Interior, for information leading to the apprehension and conviction of persons found guilty of the theft, damage, or destruction of public property: *Provided*, That the Secretary of the Interior in his administration of the Bureau of Reclamation is authorized to contract for medical attention and service for employees and to make necessary pay-roll deductions agreed to by the employees therefor: *Provided further*, That no part of any sum provided for in this Act for operation and maintenance of any project or division of a project by the Bureau of Reclamation shall be used for the irrigation of any lands within the boundaries of an irrigation district which has contracted with the Bureau of Reclamation and which is in arrears for more than twelve months in the payment of any charges due the United States, and no part of any sum provided for in this Act for such purpose shall be used for the irrigation of any lands which have contracted with the Bureau of Reclamation and which are in arrears for more than twelve months in the payment of any charges due from said lands to the United States;

"Examination and inspection of projects and operation and maintenance of reserved works: For examination of accounts and inspection of the works of various projects and divisions of projects operated and maintained by irrigation districts or water users' associations, and bookkeeping, accounting, clerical, legal, and other expenses incurred in accordance with contract provisions for the repayment of such expenses by the districts or associations; and for operation and maintenance of the reserved works of a project or division of a project when irrigation districts, water users' associations, or Warren Act contractors have contracted to pay in advance but have failed to pay their proportionate share of the cost of such operation and maintenance, to be expended under regulations to be prescribed by the Secretary of the Interior, \$10,000;

"Yuma project, Arizona-California: For operation and maintenance, \$73,000: *Provided*, That not to exceed \$25,000 from the power revenues shall be available during the fiscal year 1938 for the operation and maintenance of the commercial system;

"Orland project, California: For operation and maintenance, \$33,000;

"Boise project, Idaho: For operation and maintenance, \$30,000;

"Minidoka project, Idaho: For operation and maintenance, reserved works, \$11,600: *Provided*, That not to exceed \$65,000 from the power revenues shall be available during the fiscal year 1938 for the operation of the commercial system; and not to exceed \$100,000 from power revenues shall be available during the fiscal year 1938 for continuation of construction, south side division;

"North Platte project, Nebraska-Wyoming: Not to exceed \$60,000 from the power revenues shall be available during the fiscal year 1938, for the operation and maintenance of the commercial system; and not to exceed \$6,000 from power revenues allocated to the Northport irrigation district under subsection I, section 4, of the Act of December 5, 1924 (U. S. C., title 43, sec. 501), shall be available during the fiscal year 1938 for payment on behalf of the Northport irrigation district, to the Farmers' irrigation district for carriage of water;

"Rio Grande project, New Mexico-Texas: For operation and maintenance, \$350,000: *Provided*, That the Secretary of the Interior is hereby authorized to enter into a contract with the El Paso County Water Improvement District Numbered 1 and the Elephant Butte Irrigation District of New Mexico by which the districts will be relieved of the obligation of making payment of the construction cost chargeable to the development of power of Elephant Butte Dam in the amount determined as equitable by the Secretary of the Interior in return for the conveyance by the said two districts to the United States of all the districts' right, title, interest, and estate in the use of said dam and other project works, including the project water supply, for the development of hydroelectric energy: *Provided further*, That in such contracts it shall be stated that the use of the dam, project works, and water supply for power purposes shall not deplete or interfere with the use thereof for irrigation purposes: *Provided further*, That the net earnings of the power plant and system belonging to the United States and any other available revenues shall be applied, until the cost thereof has been met, upon the cost of the power development, including (1) the cost of power facilities, (2) the amount invested, as herein authorized, in the cost of Elephant Butte Dam, and (3) the amount invested by the Bureau of Reclamation in Caballo Dam: *Provided further*, That after the cost of the power development has been met the net earnings of the power plant and system shall be disposed of as Congress may direct.

"Owyhee project, Oregon: For operation and maintenance, \$75,000;

"Klamath project, Oregon-California: For operation and maintenance, \$54,000: *Provided*, That revenues received from the lease of marginal lands, Tule Lake division, shall be available for refunds to the lessees in such cases where it becomes necessary to make refunds because of flooding or other reasons within the terms of such leases;

"Yakima project, Washington: For operation and maintenance, \$265,000: *Provided*, That not to exceed \$25,000 from power revenues shall be available during the fiscal year 1938 for operation and maintenance of the power system;

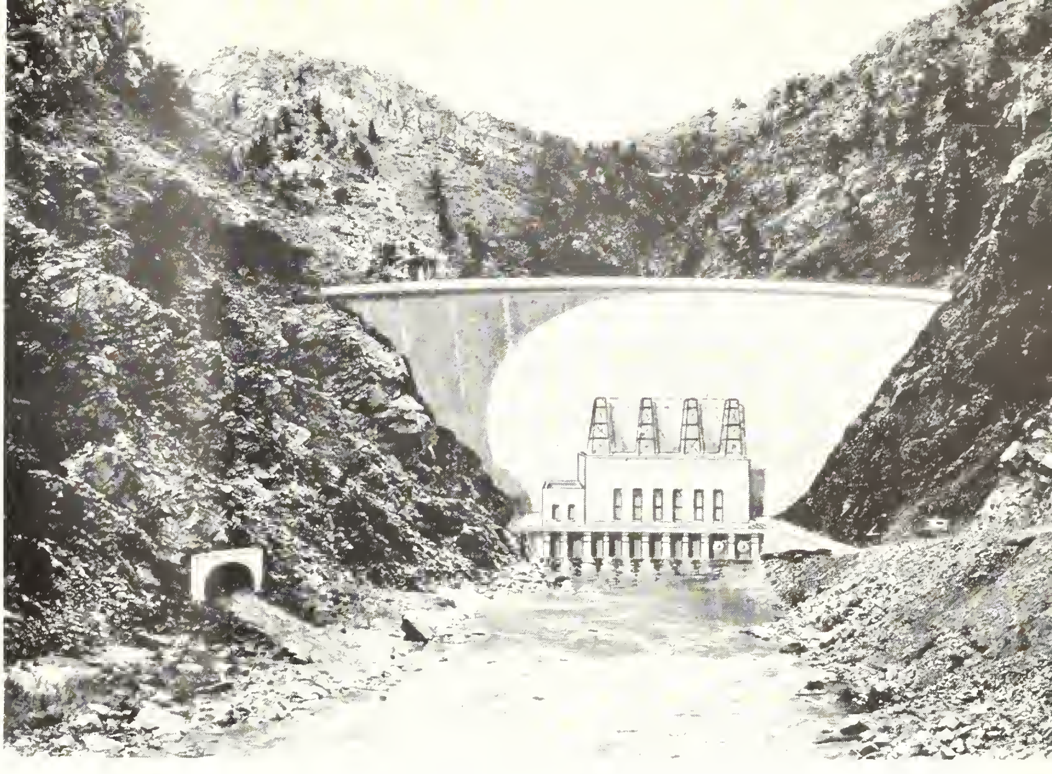
"Riverton project, Wyoming: For operation and maintenance, $40,000: *Provided*, That not to exceed $25,000 from the power revenues shall be available during the fiscal year 1938 for the operation and maintenance of the commerical system;

"Shoshone project, Wyoming: For operation and maintenance, Willwood division, $15,000: *Provided*, That not to exceed $25,000 from power revenues shall be available during the fiscal year 1938 for the operation and maintenance of the commercial system:

"Secondary and economic investigations: For cooperative and general investigations, including investigations necessary to determine the economic conditions and financial feasibility of projects and investigations and other activities relating to the reorganization, settlement of lands, and financial adjustments of existing projects, including examination of soils, classification of land, land-settlement activities, including advertising in newspapers and other publications, and obtaining general economic and settlement data, $10,000 together with the unexpended balance of the appropriation for these purposes for the fiscal year 1937: *Provided*, That the expenditures from this appropriation for any reclamation project shall be considered as supplementary to the appropriation for that project and shall be accounted for and returned to the reclamation fund as other expenditures under the Reclamation Act: *Provided further*, That the expenditure of any sums from this appropriation for investigations of any nature requested by States, municipalities, or other interests shall be upon the basis of the State, municipality, or other interest advancing at least 50 per centum of the estimated cost of such investigation;

"Operation and maintenance administration: For necessary pay of employees, traveling and other expenses incident to the general administration of reclamation projects, either operated and maintained by the Bureau or transferred to water users' organizations for operation and maintenance, including giving information and advice to settlers on reclamation projects in the selection of lands, equipment, and livestock, the preparation of land for irrigation, the selection of crops, methods of irrigation and agricultural practice, and general farm management, the cost of which shall be charged to the general reclamation fund and shall not be charged as a part of the construction or operation and maintenance cost payable by the water users under the projects, $50,000;

"Limitation of expenditures: Under the provisions of this Act no greater sum shall be expended, nor shall the United States be obligated to expend during the fiscal year 1938, on any reclamation project appropriated for herein, an amount in excess of the sum herein appropriated therefor,



ARTIST'S CONCEPTION OF SEMINOLE DAM ON THE NEWLY NAMED KENDRICK PROJECT, WYOMING

nor shall the whole expenditures or obligations incurred for all of such projects for the fiscal year 1938 exceed the whole amount in the reclamation fund for the fiscal year;

"Interchange of appropriations: Ten per centum of the foregoing amounts shall be available interchangeably for expenditures on the reclamation projects named; but not more than 10 per centum shall be added to the amount appropriated for any one of said projects, except that should existing works or the water supply for lands under cultivation be endangered by floods or other unusual conditions an amount sufficient to make necessary emergency repairs shall become available for expenditure by further transfer of appropriation from any of said projects upon approval of the Secretary of the Interior;

"Construction: For continuation of construction of the following projects in not to exceed the following amounts, respectively, to be expended from the Reclamation Fund under the same general condition and in the same manner and for the same objects of expenditure as specified for projects hereinbefore in this Act under the caption 'Bureau of Reclamation', and to be reimbursable under the reclamation law:

"Gila project, Arizona, $700,000; said Gila project, including the waters to be diverted and used thereby and the lands and structures for the diversion and storage thereof, to be subject to the provisions of the Boulder Canyon Project Act of December 21, 1928, and subject to and controlled by the provisions of the Colorado River Compact signed at Santa Fe, New Mexico, November 24, 1922;

"Salt River project, Arizona, $500,000;

"Orland project, California: For construction and other work authorized by section 5 of the Act of June 24, 1936 (49 Stat. 1907), $35,000;

"Colorado-Big Thompson project, Colorado: For construction in accordance with the plan described in Senate Document Numbered 80, Seventy-fifth Congress, $900,000: *Provided*, That no construction thereof shall be commenced until the repayment of all costs of the project shall, in the opinion of the Secretary of the Interior, be assured by appropriated contracts with water conservancy districts, or irrigation districts or water users' associations organized under the laws of Colorado, or other form of organization satisfactory to the Secretary of the Interior;

"Pine River project, Colorado, $500,000;

"Boise project, Idaho, Payette division, $1,000,000;

"Sun River project, Montana, $300,000;

"Carlsbad project, New Mexico, $200,000;

"Owyhee project, Oregon, $500,000;

"Klamath project, Oregon-California, $125,000;

"Belle Fourche project, South Dakota, $130,000;

"Ogden River project, Utah, $250,000;

"Provo River project, Utah, $750,000;

"Yakima project, Washington, Roza division, $1,500,000;

"Casper-Alcova project, Wyoming, $650,000: *Provided*, That in recognition of the respective rights of both the States of Colorado and Wyoming to the amicable use of the waters of the North Platte River, neither the construction, maintenance, nor operation of said project shall ever interfere with the present vested rights or the fullest use hereafter for all beneficial purposes of the waters of said

stream or any of its tributaries within the drainage basin thereof in Jackson County, in the State of Colorado, and the Secretary of the Interior is hereby authorized and directed to reserve the power by contract to enforce such provisions at all times: *Provided further*, That from and after the passage of this Act, the reclamation project heretofore known as the Casper-Alcova project shall be known and designated on the public records as the Kendrick project, and that the change in the name of said project shall in no wise affect the rights of the State of Wyoming or the State of Colorado or any county, municipality, corporation, association, or person, and all records, surveys, maps, and public documents of the United States or of either of said States in which said project is mentioned or referred to under the name of the Casper-Alcova project shall be held to refer to said project under and by the name of the Kendrick project;

"Riverton project, Wyoming, $200,000;

"Shoshone project, Wyoming: Heart Mountain division, $700,000; Willwood division, $10,000; in all, $710,000;

"Colorado River Basin investigations, $150,000;

"For administrative expenses on account of the above projects, including personal services and other expenses in the District of Columbia and in the field $750,000, in addition to and for the same objects of expenditure as are hereinbefore enumerated in paragraphs 2 and 3 under the caption 'Bureau of Reclamation'; in all, $9,850,000: *Provided*, That of this amount not to exceed $75,000 may be expended for personal services in the District of Columbia.

"The unexpended balances of the amounts appropriated from the reclamation fund, special fund, under the caption 'Bureau of Reclamation, Construction', in the Interior Department Appropriation Act, fiscal year 1937, shall remain available for the same purposes for the fiscal year 1938.

"Total, from reclamation fund, $11,016,600.

"To defray the cost of operating and maintaining the Colorado River front work and levee system adjacent to the Yuma Federal irrigation project in Arizona and California, subject only to section 4 of the Act entitled 'An Act authorizing the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes', approved January 21, 1927 (44 Stat., p. 1010), $15,000, together with the unexpended balance of the appropriation for the fiscal year 1937.

"Boulder Canyon project: For the continuation of construction of the Boulder Canyon Dam and incidental works in the main stream of the Colorado River at Black Canyon, to create a storage reservoir, and of a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from such reservoir; to acquire by proceedings in eminent domain or otherwise, all lands, rights-of-way, and other property necessary for such purposes; and for incidental operations, as authorized by the Boulder Canyon Project Act, approved December 21, 1928 (U. S. C., title 43, ch. 12A); $2,550,000, to be immediately available and to remain available until advanced to the Colorado River Dam fund, of which sum not exceeding $50,000 shall be immediately available for the construction of a schoolhouse in Boulder City; and there shall also be available from power and other revenues not to exceed $500,000 for operation and maintenance of the Boulder Canyon Dam, power plant, and other facilities; which amounts of $2,550,000 and $500,000 shall be available for personal services in the District of Columbia (not to exceed $25,000) and in the field and for all other objects of expenditure that are specified for projects hereinbefore included in this Act, under the caption 'Bureau of Reclamation, Administrative provisions and limitations', without regard to the amounts of the limitations therein set forth.

"Boulder Canyon project (All-American Canal): For continuation of construction of a diversion dam, and main canal (and appurtenant structures) located entirely within the United States connecting the diversion dam with the Imperial and Coachella Valleys in California; to acquire by proceedings in eminent domain, or otherwise, all lands, rights-of-way, and other property necessary for such purposes; and for incidental operations, as authorized by the Boulder Canyon Project Act, approved December 21, 1928 (U. S. C., title 43, ch. 12A); to be immediately available and to remain available until advanced to the Colorado River Dam Fund, $1,500,000, which amount shall be available for personal services in the District of Columbia (not to exceed $5,000) and in the field and for all other objects of expenditure that are specified for projects hereinbefore included in this Act under the caption 'Bureau of Reclamation, administrative provisions and limitations', without regard to the amounts of the limitations therein set forth.

"For continuation of construction of the following projects and for general investigations in not to exceed the following amounts, respectively, to be expended from the general fund of the Treasury in the same manner and for the same objects of expenditure as specified for projects included hereinbefore in this Act under the caption 'Bureau of Reclamation', and to be reimbursable under the reclamation law:

"Central Valley project, California, $12,500,000, together with the unexpended balance of the appropriation for this project contained in the First Deficiency Act, fiscal year 1936;

"Grand Coulee Dam, Washington: For continuation of construction of Grand Coulee Dam and appurtenant works, $13,000,000, together with the unexpended balance of the appropriation for this dam contained in the Interior Department Appropriation Act, fiscal year 1937;

"For general investigations, $200,000 to enable the Secretary of the Interior, through the Bureau of Reclamation, to carry on engineering and economic investigations of proposed Federal reclamation projects, surveys for reconstruction, rehabilitation, or extension of existing projects and studies of water conservation and development plans, such investigations, surveys, and studies to be carried on by said Bureau either independently, or, if deemed advisable by the Secretary of the Interior, in cooperation with State agencies and other Federal agencies, including the Corps of Engineers, National Resources Committee, and the Federal Power Commission;

"For administrative expenses on account of the above projects, including personal services in the District of Columbia and in the field, $750,000, in addition to and for the same objects of expenditure as are hereinbefore enumerated in paragraphs 2 and 3 under the caption 'Bureau of Reclamation'; in all, $26,450,000: *Provided*, That of this amount not to exceed $75,000 may be expended for personal services in the District of Columbia.

"The Public Works Administration allotments made available to the Department of the Interior, Bureau of Reclamation, pursuant to the National Industrial Recovery Act of June 16, 1933, either by direct allotments or by transfer of allotments originally made to another Department or agency, and the allocations made to the Department of the Interior, Bureau of Reclamation, from the appropriation contained in the Emergency Relief Appropriation Act of April 8, 1935, shall remain available for the purposes for which allotted during the fiscal year 1938.

*   *   *   *   *

"SEC. 2. Appropriations herein made for field work under the Office of the Secretary, the General Land Office, the Bureau of Indian Affairs, the Bureau of Reclamation, the Geological Survey, the Bureau of Mines, and the National Park Service shall be available for the hire, with or without personal services, of work animals and animal-drawn and motor-propelled vehicles and equipment.

A NEW cooperative canning plant, with a capacity of 1,000 cases in 10 hours, has been completed at Fruitdale, Idaho, near the Owyhee project. Fruitland is about 3½ miles from Ontario, Oreg., so the plant is close enough to handle crops grown on the project.

Young Grapefruit Trees Never Grow Big Unless Watered Right

By Dr. G. E. P. Smith, Agricultural Engineer, University of Arizona

GRAPEFRUIT ORCHARD ON YUMA MESA, YUMA PROJECT, ARIZONA-CALIFORNIA.

YEARS ago the head gardener at the University of Arizona, a man of Mexican descent who clung fondly to his own language, stated the following aphorism to the writer: "Once a little tree, always a little tree." From studies made on the Yuma Mesa during the past 10 years, there appears to be considerable truth in that maxim. A deficiency in growth during the early years persists, the trees do not "catch up" in later years, and the first years of growth are therefore important.

The Irrigation Department 5 years ago initiated tests of various irrigation practices and methods of soil temperature control. Five plots of 39 trees each, newly set, were given treatments.

One plot was sown to alfalfa, and although the alfalfa depressed the soil temperature effectively, the trees made no growth whatever. Any advantage in the months of July, August, and September was counteracted by the positive injury in the spring months. The trees clung to life desperately, but "marked time." If alfalfa is used to provide green manuring, it must be kept at a safe distance away from the trees.

The cowpeas plot, on which cowpeas were planted each summer about the end of May and turned under in late September, provided much better conditions for growth of the young grapefruit trees; and yet the results there were less favorable than on the check plot which was kept bare and was irrigated weekly through the summer months.

STRAW WAS REAL HELP

The best growth was on the straw-mulch plot, on which a mat of coarse, nonheating straw was placed around each tree early in June and removed in late September. With the cool soil and no unfavorable influences, the trees of this plot, from the very outset, "walked away" from all the others and each year the lead over the other plots has increased. All the trees on this plot are uniformly large and handsome.

There can be no doubt as to the best treatment for young orchards. A straw mulch and 2 or 3 weeks' irrigation intervals is vastly preferable to weekly irrigations on a bare soil, even for the loose, porous, sandy soil of the Yuma Mesa.

The plot with a sesbania cover crop did poorly. Sesbania in a citrus orchard has nothing to recommend it.

The special treatments were discontinued after 3 years, and the plots since then have been kept bare and given the regular orchard irrigation schedule which includes biweekly irrigations during the hot summer. It was desired to see whether the early treatments would have carry-over effects in succeeding years. Under the regular schedule all plots, even the alfalfa plot, have made good growth; but the relative order of rates of growth has been maintained and the trees which were straw-mulched when young are outdistancing the others.

OTHER EVIDENCE

These tests confirm previous tests which were made jointly by the horticulture and irrigation departments and were reported in Technical Bulletin No. 37. The plots in that series were given irrigations on 1-, 2-, 3-, 4-, 5-, and 6-week intervals over a period of 5 years from 1927 to 1932. The development of the trees was in the order of the frequencies. Today, after 5 years of regular orchard practice, the treetops retain their stair-steps relations. The trees which had the early advantage of 1-week irrigations are more than twice the volume and production capacity of those at the other end of the series.

Economically, it is essential to bring a young orchard into production as early as possible. An enterprise may be rated as profitable if several boxes of fruit per tree can be harvested the fifth or sixth year; it may be ill-advised and a failure if 3 to 5 more years elapse before a good crop can be picked.—*Arizona Producer, July 15, 1937.*

Minidoka Experiments in Processing Green Peas

The Otato Corporation of Burley, Idaho, on the Minidoka project, is making an interesting experiment in the processing of green peas for human food. Last spirng, contracts were made with a few farmers for the growing of about 25 acres of the peas at a price of $40 per ton for the shelled peas, the company furnishing the seed. Harvesting of the crop was completed the middle of July with very satisfactory results.

The pea vines were cut with a mower and hauled direct to the factory, where the peas were harvested and made into flour by a process similar to that used for making potato flour. Some of the fields yielded 2 to 3 tons per acre, with a minimum of labor and expense for growing. If the outcome of the tests should prove successful, the operations of the plant will be extended next year.

A Successful Gopher Control Contest

By Henry Frauenfelder, President, Yuma County Water Users' Association

AN OUTLINE of the plan to control pocket gophers on the Valley division of the Yuma project appeared in the March issue of the Reclamation Era. Since that time this successful contest has come to a close. It was sponsored by the Yuma County Water Users' Association and carried out by the pupils enrolled in the five rural schools located in the Valley division. Beginning about the middle of February and scheduled to continue until April 30, it was anticipated that during the campaign a total of 10,000 or more gophers would be trapped. Actually 22,068 were accounted for, which is greatly in excess of the largest number ever caught on the Yuma project in a like period of time. These, together with 3,502 gophers trapped by the regular project forces and 3,290 caught by the E. C. W. rodent control crew during the first 4 months of 1937, accounted for the extermination of 28,860 of these trouble-making pests this year on the Valley division.

Pocket gophers are generally found throughout the desert regions of the Southwest. These burrowing vegetative animals thrive and multiply rapidly on irrigation projects as the moist loose earth of canal banks and borders in irrigated fields offer ideal conditions for runways and nesting places, and bountiful food supplies are afforded by field crops always close at hand. Burrowing activities of these little animals are often the direct cause of breaks in canal and ditch banks, with resultant property damage as well as interference and delay in the delivery of water to project farms. Apparently the gophers are most active in the spring months of the year, during which season their depredations are more extensive than at any other time.

The high degree of success attained in this spring's rodent control campaign was due mainly to the enthusiastic cooperation of everyone concerned. Interest in the contest never lagged.

The services of a rodent-control specialist, Mack Taylor, were contributed by the United States Bureau of Biological Survey. Mr. Taylor instructed the school pupils in the proper methods of trapping gophers, visiting all the valley rural schools at least twice each week. At regular 2-week intervals, he collected the tails that contestants were required to turn in as evidence of the number of gophers trapped, and for which they were paid at the rate of 2 cents each. Farmers, realizing the value of an effective clean-up of gophers, offered additional liberal rewards, ranging from 3 to 5 cents per tail.

WINNERS IN THE FIVE VALLEY SCHOOLS, TOGETHER WITH MACK TAYLOR, BIOLOGICAL SURVEY RODENT CONTEST SPECIALIST (LEFT) AND HENRY FRAUENFELDER, PRESIDENT, YUMA COUNTY WATER USERS' ASSOCIATION (RIGHT).

At regular intervals the Yuma Daily Sun gave prominent space to news stories, containing interesting facts concerning the progress of the contest. Principals and teachers posted clippings of these news articles on their school bulletin boards as they were especially interesting to contestants and simulated a healthy rivalry, which rapidly developed between the several schools and the individual contestants. Prizes of \$5, \$3.50, and \$2 were offered the three winners in each of the five school districts, while similar amounts were held out as rewards for the three contestants leading the entire valley at the close of the campaign. Early in the contest, it became evident that a record number of gophers would be caught for both boys and girls in large numbers entered enthusiastically into the spirit of the contest.

The names of valley winners are given below. It is interesting to note that a girl won first prize in one of the school districts.

GRAND PRIZE WINNERS FOR ENTIRE VALLEY

First, Roy Cook, Somerton, 1,446 gophers.

Second, Juan Castillo, Gadsden, 1,308 gophers.

Third, Diggs Walton, Somerton, 1,289 gophers.

Expensive repairs in canal banks are often necessary as a result of breaks caused by gophers. The splendid results obtained at minimum cost in this year's gopher control contests are very gratifying to the officials of the Yuma County Water Users' Association, who sponsored the campaign, and it is very likely that it will be made an annual affair for some years to come.

EXPENSIVE CANAL BREAKS ARE FREQUENTLY CAUSED BY BURROWINGS OF GOPHERS.

Anti Noxious Weed Board Wages War on Yuma Valley Weeds

Eight years ago forward-looking farmers of the Yuma project, realizing the enormous toll of weeds against their farm income, filed a petition with the board of supervisors of Yuma County for the organization of an anti noxious weed district to provide for the eradication and control of noxious weeds and grasses, as authorized under the noxious weeds law, article V, chapter V of the 1928 Revised Codes of Arizona.

The petition was approved by the board of supervisors, and an election was called to determine whether such district should be organized. Landowners of the valley voted in favor of a weed-control district to be known as the Yuma Valley Anti Noxious Weed District.

The affairs of the Yuma Valley anti-noxious weed district are administered by a board of directors, consisting of three members elected at large from the district for a term of 2 years. This board appoints an inspector to examine all lands lying within the weed-control district, including all rights-of-way of irrigation ditches and all roads, highways, streets, and other thoroughfares. If noxious weeds or grasses are found, notice of their presence is served upon the owner or tenant. The board of directors also has the right to declare and enforce quarantine against land upon which noxious weeds or grasses are found in order that no article or product of any kind capable of carrying the seed of such noxious weeds be removed during the period of quarantine. The owner may eradicate such noxious weeds or grasses, but if he fails or refuses to carry through such work to successful completion, the board may direct the inspector to have such weeds or grasses eradicated and the actual cost and expense of this work declared a lien upon his land.

The present directors of the Yuma Anti Noxious Weed Board, R. H. Thielmann, Joe E. Turrentine, and Felix Segula, were elected 4 years ago and reelected in March of this year. The board has worked in close cooperation with farmers of the valley lands and has sponsored an outstanding educational program to inform valley farmers of the importance of eradicating noxious weeds. Many farmers have voluntarily assumed the initiative in clearing their lands of noxious weeds, and, in other cases, notice from the board has resulted in the owners taking appropriate action on their own responsibility.

An important part of the program of the Anti Noxious Weed Board has been the insertion of an article on weed control and eradication each week on the farm page of the Yuma Daily Sun. These articles keep farmers informed on ways to identify new or unfamiliar weeds, the habits and characteristics of these weeds, methods of eradication, the progress of weed research and experiments, and weed-control programs in other parts of the country. The following interesting except from this series of articles that recently appeared in the Yuma Daily Sun:

"In the work of eradicating weeds, we have under way one of the foulest tracts in the district. It is a 15-acre tract planted in the best showing of pecans on perhaps some of the best pecan land, very soft, sandy and with enough loam to make it fertile.

"Last year it had a strong growth of puncture vine, grass burs, quite a quantity of Johnson grass and on one side plenty of cockle burs.

"The land is level, well bordered and the rows of trees are set about one disk width from the borders. The seeds of these weeds generally ripened. However, before any sprouted this spring the dry vegetation was cleared from under the trees and a fair job of burning the whole tract accomplished.

"On May 15 the second disking was begun lengthwise of the tree rows. It is intended to follow this by cross disking and working as close to the edges as possible. Disking will be repeated between irrigations, keeping close watch on all skips and irregularities.

"The primary object is to start every seed and then kill the plant that comes from it and prevent new seed from existing."

As a check on weed control already undertaken in the valley and as a basis for future plans, the board is now making a survey of noxious weeds, using the new weed survey cards recently prepared by the Operation and Maintenance Division of the Bureau of Reclamation. The card provides for listing all areas of noxious and poisonous weeds along ditches and drains and for compiling the acreage of weeds causing serious damage to crops, acreage where infestation is light and not yet noticeably affecting crops, acreage where weeds have taken over the land and no crops are grown. A quarter section diagram on the reverse side of the card is used to indicate graphically the location of all weed-infested areas. From these diagrams, the area and degree of infestation will be plotted on a county section map.

The Anti-Noxious Weed Board has declared war on Yuma Valley weeds and it will be interesting to follow in the articles of the Yuma Daily Sun the weekly news of its campaign to combat weeds encroaching on the fertile lands of Yuma Valley.

Marshall Ford Dam Allotted $5,000,000

An allotment of $5,000,000 from emergency funds for the fiscal year 1938 had been made for continuation of construction of Marshall Ford Dam, 12 miles above Austin, on the Colorado River of Texas.

Marshall Ford Dam is one of a series of dams planned for the river by the Lower Colorado River Authority, a Texas agency, and designed to regulate the flow of the river for flood control, incidental power, and irrigation. The Marshall Ford Dam is being constructed by the Bureau of Reclamation as the Federal Government's contribution to the flood-control program, and the other structures are being built by the Authority.

This dam will be constructed in two stages. The first stage, which calls for a concrete masonry dam 192 feet high and 2,285 feet long, to store 800,000 acre-feet of water, is now under construction. The second stage, by which the dam would be raised to a height of 270 feet for the storage of 2,550,000 acre-feet of water, may be undertaken in the future.

Construction of Marshall Ford Dam was begun with an allotment of $5,000,000 of funds from the Emergency Relief Act of 1935 to the Bureau of Reclamation. The contract for construction of the dam was awarded by Secretary of Interior Harold L. Ickes, December 3, 1936, and the structure was 10.5-percent complete July 1, 1937. The contract was awarded to Brown & Root, Inc., of Austin, and the McKenzie Construction Co., of San Antonio, on their joint bid of $5,781,235.

Several contracts for the purchase of materials and machinery for the dam also have been awarded, included among them contracts totaling $1,786,379.94 for manufacture of 24 sets of control gates and appurtenances for the outlet works and contracts totaling $495,250 for cement.

The allotment just received brings to a total of $10,000,000 funds made available for construction of Marshall Ford Dam.

CONSTRUCTION of a packing house 75 by 170 feet in size has been started by the Richey & Gilbert Co. at Tieton, Wash. (Yakima project). The warehouse is estimated to cost $10,000 to $12,000, and will contain modern washing and packing equipment.

THE Humboldt project reports that many men have been reemployed in the mining industry on nearby properties. Interest is increasing and a gradual improvement and development in mining activities is noted.

Bills introduced in the first session of the Seventy-fifth Congress of interest to the Bureau of Reclamation

INSTALLMENT NO. 2

Number	Title	Author	Date introduced	Action
H. R. 3035 (see also H. R. 6210).	To amend the act entitled "An act for the relief of unemployment through the performance of useful public work, and for other purposes", approved Mar. 31, 1933.	Mr. Scrugham	Jan. 14, 1937	Referred to Committee on Mines and Mining.
H. R. 3354	For the relief of the Great Northern Ry. Co	Mr. O'Connor	Jan. 19, 1937	Approved by the President June 7, 1937. Private, No. 126.
H. R. 3408 (see also H. J. Res. 97).	To amend the Civil Service Act approved Jan. 16, 1883 (22 Stat. 403), and for other purposes (married persons clause).	Mr. Celler	Jan. 21, 1937	Approved by President July 26, 1937. Public, No. 212.
H. R. 3423 (see also H. R. 1603, S. 1195).	To provide for the preferred employment of American citizens by the Government of the United States.	Mr. Starnes	do	Passed by House July 19, 1937. Referred to Senate Committee on Education and Labor July 20, 1937.
H. R. 3425 (see also S. 324)	Providing payment to employees, Bureau of Reclamation, for mileage traveled in privately owned automobiles.	Mr. Dempsey	do	Passed by House Feb. 15, 1937. Referred to Senate Committee on Irrigation and Reclamation Feb. 17, 1937.
H. R. 3557 (see also S. 405)	For the relief of the Coast Fir & Cedar Products Co., Inc	Mrs. Honeyman	Jan. 22, 1937	Approved by the President June 24 1937. Private, No. 172.
H. R. 3590 (see references under H. R. 8).	To create the Farm Tenant Home Purchase Corporation, to promote the purchase of farms and farm homes by farm tenants, and for other purposes.	Mr. Johnson	Jan. 25, 1937	Referred to Committee on Agriculture.
H. R. 3592 (see also H. R. 3788, H. R. 4347).	To improve the navigability of the Arkansas River and the White River in Arkansas and Missouri, to provide for flood control of the Mississippi River and the Arkansas and White River, to provide for reforestation and the use of marginal lands; for the agricultural and industrial development; for the irrigation of lands; for the restoration and preservation of the water level and for the development of electrical power in the Arkansas and White River Valley, and for other purposes.	Mr. Miller	do	Referred to Committee on Flood Control.
H. R. 3629	To provide for establishing engineering experiment stations at the land-grant colleges.	Mr. Green	do	Referred to Committee on Agriculture.
H. R. 3682 (see references under H. R. 273).	To amend the act of Mar. 4, 1923, entitled "An act to provide for the classification of civilian positions within the District of Columbia and within the field services, and amendments thereto."	Mr. Connery	Jan. 26, 1937	Referred to Committee on Civil Service.
H. R. 3786	Providing for the allocation of net revenues of the Shoshone power plant of the Shoshone reclamation project in Wyoming.	Mr. Greever	Jan. 27, 1937	Reported from Committee on Irrigation and Reclamation Aug. 15, 1937.
H. R. 3788 (see also H. R. 3592, H. R. 4347).	To improve the navigability and to provide for the flood control of the upper Mississippi River; to provide for reforestation and the use of marginal lands in, and for the agricultural and industrial development of, the upper Mississippi River Basin; to provide for the restoration and preservation of the water level, and for the development of electrical power, in the upper Mississippi Basin; and for other purposes.	Mr. Kvale	do	Referred to Committee on Flood Control.
H. R. 3872	To create an executive department of the Government to be known as the Department of Inland Watercourses.	Mr. Gray	Jan. 28, 1937	Referred to Committee on Expenditures in the Executive Departments.
H. R. 3876 (see references under H. R. 8).	To encourage and promote the ownership of farm homes and to make the possession of such homes more secure, to provide for the general welfare of the United States, to provide additional credit facilities for agricultural development, and for other purposes.	Mr. Vinson	do	Referred to Committee on Agriculture.
H. R. 3889 (see also S. 1275)	Relating to the authority of the Reconstruction Finance Corporation to make rehabilitation loans for the repair of damages caused by floods or other catastrophes, and for other purposes.	Mr. Polk	do	Referred to Committee on Banking and Currency.
H. R. 4096 (see also H. R. 5043).	Granting the consent of Congress to any 2 or more States to enter into agreements or compacts for cooperative effort and mutual assistance in the preservation of wildlife resources.	Mr. Byrne	Feb. 1, 1937	Referred to Committee on Judiciary.
H. R. 4193 (see references under H. R. 258).	To create United States Civil Service Boards of Appeals	Mr. Pearson	Feb. 2, 1937	Referred to Committee on Civil Service.
H. R. 4220 (see references under H. R. 8).	To provide homes and farms for the tenant farmers and sharecroppers of the United States, and for other purposes.	Mr. Wood	do	Referred to Committee on Agriculture.
H. R. 4269 (see also H. R. 161, S. 1830).	To provide for a useful and comprehensive system for the impounding, storing, conserving, and making use of the unappropriated waters falling or emanating within the United States, and for other purposes.	Mr. Lemke	Feb. 3, 1937	Referred to Committee on Flood Control.
H. R. 4347 (see also H. R. 3592, H. R. 3788).	To improve the navigability and to provide for the flood control of the upper Mississippi River; to provide for reforestation and the use of marginal lands in, and for the agricultural and industrial development of, the upper Mississippi River Basin; to provide for the restoration and preservation of the water level, and for the development of electrical power, in the upper Mississippi Basin, and for other purposes.	Mr. Withrow	Feb. 4, 1937	Do.
H. R. 4410 (see also S. 1304)	To provide for an adequate survey and classification of the soil resources of the United States; to provide for a system of soil conservation; to provide for the prevention of interstate floods; to provide for an ever-normal granary; to provide for a system of commodity loans; to provide for disposal of excess production of agricultural products; to provide for the regulation of imports of farm products, and for other purposes.	Mr. Maverick	Feb. 5, 1937	Referred to Committee on Agriculture.
H. R. 4479 (see references under H. R. 295).	To amend the act entitled "An act to amend the act entitled 'An act for the retirement of employees of the classified civil service, and for other purposes', approved May 22, 1920, and acts in amendment thereof", approved July 3, 1926, and May 29, 1930.	Mr. Dockweiler	Feb. 8, 1937	Referred to Committee on the Civil Service.
H. R. 4481 (see also H. R. 5016, H. R. 6180, H. R. 6551, H. Doc. 196, S. 2102).	To make CCC a permanent agency	Mr. Citron	do	Referred to Committee on Labor.
H. R. 4503 (see also S. 1440)	To provide for the control of the flood waters of the rivers of the United States, for the improvement of navigability of such rivers, for reforestation and conservation of natural resources, and for other purposes.	Mr. Secrest	Feb. 10, 1937	Referred to Committee on Flood Control.
H. R. 4658 (see references under H. R. 1590)	Relating to the eligibility of certain persons for admission to the civil service	Mr. Sutphin	Feb. 11, 1937	Referred to Committee on Civil Service.
H. R. 4720	Making appropriations for the Treasury and Post Office Departments for the fiscal year ending June 30, 1938, and for other purposes.	Mr. Ludlow	Feb. 15, 1937	Approved by President May 14, 1937. Public, No. 77.
H. R. 4791 (see also H. R. 5913, H. R. 7319, H. R. 7363, S. 2341).	To continue the Federal Emergency Administration of Public Works and to finance additional public-works projects.	Mr. Beiter	Feb. 16, 1937	Referred to Committee on Ways and Means.
H. R. 4849	To provide for the alteration of or changes to bridges over navigable waters of the United States, for the apportionment of the cost of such changes or alterations between the United States and the owner or owners of such bridges, to authorize the appropriation of funds for such purposes, and to repeal all inconsistent laws.	Mr. Hobbs	Feb. 17, 1937	Referred to Committee on Interstate and Foreign Commerce.

Number	Title	Author	Date introduced	Action
H. R. 4884	To compel Government departments and officials to give full faith and credit to the decrees, judgments, etc., of State courts of record.	Mr. Disney	Feb. 18, 1937	Referred to Committee on Judiciary.
H. R. 4945	To appropriate a sum of money for drought relief purposes	Mr. Hull	Feb. 19, 1937	Referred to Committee on Appropriations.
H. R. 4948 (see also H. R. 6151, H. R. 6387, H. R. 6973, H. R. 7010, H. R. 7642, S. 2092, S. Doc. 21).	To authorize the maintenance and operation of Bonneville project for navigation and flood control, and for other purposes.	Mr. Smith	do	Referred to Committee on Rivers and Harbors.
H. R. 4959	To enable farmers in disaster areas to pay their seed and feed loans by working on farm-to market roads and water-control projects.	Mr. Case	do	Referred to Committee on Agriculture.
H. R. 5043 (see also H. R. 4096).	Granting the consent of Congress to any 2 or more States to enter into agreements or compacts for cooperative efforts and mutual assistance in the preservation of wildlife resources.	Mr. Byrne	Feb. 24, 1937	Do
H. R. 5122	To authorize certain officers and employees to administer oaths to expense accounts.	Mr. Cochran	Feb. 25, 1937	Passed by House Mar. 15, 1937. Referred to Senate Committee on Judiciary Mar. 17, 1937.
H. R. 5175	To provide for the control of the floodwaters of the Flathead River and its tributaries; to provide for irrigation of arid and semiarid lands in the Flathead River Valley; to provide for the agricultural and industrial development of the Flathead River Valley; to provide for the creation of the Hungry Horse Power Authority; to provide for the generation, distribution, and sale of electricity at the Hungry Horse Dam, and for other purposes."	Mr. O'Connell	Mar. 1, 1937	Referred to Committee on Flood Control.
H. R. 5248 (see also S. 1755).	To provide for the further improvement of the Columbia and Snake Rivers in Oregon and Idaho.	Mr. Pierce	Mar. 2, 1937	Referred to Committee on Rivers and Harbors.
H. R. 5294	To reserve certain lands on the public domain in California and Nevada for the use and benefit of Indians of the Fort Mohave Reservation.	Mr. Rogers	Mar. 3, 1937	Referred to Committee on Indian Affairs.
H. R. 5362 (see references under H. R. 8).	To encourage and promote the ownership of farm homes and to make the possession of such homes more secure, to provide for the general welfare of the United States, to provide additional credit facilities for agricultural development, and for other purposes.	Mr. Whelchel	Mar. 5, 1937	Referred to Committee on Agriculture.
H. R. 5363 (see also H. R. 1602, H. R. 2712).	To amend the act of Sept. 7, 1916, entitled "An act to provide compensation for employees of the United States suffering injuries while in the performance of their duties, and for other purposes."	Mr. Boileau	do	Referred to Committee on Judiciary.
H. R. 5415 (see also S. 976)	Relating to labor preferences in connection with certain Public Works projects.	Mr. Scrugham	Mar. 8, 1937	Referred to Committee on Ways and Means.
H. R. 5533 (see references under H. R. 295).	Amending the Civil Service Retirement Act	Mr. Boren	Mar. 10, 1937	Referred to Committee on Civil Service.
H. R. 5586 (see also S. 1815)	To provide for the construction of 4 bridges across the United States reclamation A canal in Klamath Falls, Oreg.	Mr. Pierce	Mar. 12, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 5635 (see also S. 1935)	For relief of disbursing officers	Mr. Cochran	Mar. 15, 1937	Referred to Committee on Expenditures in the Executive Departments.
H. R. 5693 (see also S. 1800)	Providing for the cancelation of certain charges against the Klamath drainage district of Klamath County, Oreg., and charging such unpaid balance to the unentered public lands within the district.	Mr. Pierce	Mar. 16, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 5721 (see also H. R. 282)	To amend the Federal Register Act	Mr. Celler	Mar. 17, 1937	Approved by President June 19, 1937. Public, No. 158.
H. R. 5758	To authorize the creation of a permanent revolving fund for loans to levee, drainage, irrigation, and reclamation districts, mutual nonprofit companies, and incorporated water-users' associations.	Mr. Driver	Mar. 18, 1937	Referred to Committee on Banking and Currency.
H. R. 5779	Making appropriations for the Departments of State and Justice and for the judiciary, and for the Departments of Commerce and Labor, for the fiscal year ending June 30, 1938, and for other purposes	Mr. McMillan		Approved by the President June 16, 1937. Public, No. 153.
H. R. 5822	To provide for the continuation and expansion of the Federal works program for the development of a planned, long-range public-works program for grants and aid by the Federal Government to the several States on relieving hardship and suffering by unemployment, and for other purposes.	Mr. Boileau	Mar. 22, 1937	Referred to Committee on Appropriations.
H. R. 5828	To Provide a preliminary examination of the Fountaine Qui Bouille (Fountain) River and its tributaries in the State of Colorado, with a view to the control of their floods and the conservation of their waters.	Mr. Martin	do	Passed by House May 3, 1937. Referred to Senate Committee on Commerce May 6, 1937.
H. R. 5853 (see references under H. R. 108).	To create a commission and to extend further relief to water users on United States reclamation projects and on Indian irrigation projects.	Mr. White	Mar. 23, 1937	Indefinitely postponed. House passed S. 413 on Aug. 12, 1937.
H. R. 5863 (see references under H. R. 155).	Making appropriations to provide supplemental funds for relief and work relief.	Mr. Johnson	do	Referred to Committee on Appropriations.
H. R. 5899	To extend the Irrigation Act approved June 17, 1902, to Puerto Rico.	Mr. Iglesias	Mar. 24, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 5943 (see references under H. R. 4791).	To continue the Federal Emergency Administration of Public Works for 2 years, and for other purposes.	Mr. Martin	Mar. 25, 1937	Referred to Committee on Appropriations.
H. R. 5959 (see also H. R. 5961).	Providing that the Secretary of Agriculture create a special "dust bowl" area in Kansas, Oklahoma, Colorado, New Mexico, and Texas.	Mr. Ferguson	Mar. 29, 1937	Referred to Committee on Agriculture.
H. R. 5960 (see also H. R. 7953, H. R. 7954, S. 2820, and S. 2821).	To provide for studies and plans for the development of a certain reclamation project on the Cimarron River in Cimarron County, Okla.	do	do	Withdrawn from calendar Aug. 2, 1937.
H. R. 5961 (see also H. R. 5959).	To make an appropriation for the Secretary of Agriculture to create a special "dust bowl" area in 5 Southwestern States, and for the establishment of grass breeding and experiment projects.	do	do	Referred to Committee on Appropriations.
H. R. 5969	To amend an act entitled "An act to establish a uniform system of bankruptcy throughout the United States", approved July 1, 1898, and acts amendatory thereof and supplementary thereto. (Sec. 81 deals with reclamation, irrigation, and drainage districts).	Mr. Sumners of Texas	do	Passed by House June 24, 1937. Reported from Senate Committee on Judiciary July 22, 1937.
H. R. 5973	Making appropriation for the maintenance and expansion of the soil conservation work of the Civilian Conservation Corps.	Mr. Boren	do	Referred to Committee on Appropriations.
H. R. 5997 (see references under H. R. 2512).	To authorize an appropriation for the survey and construction of small reservoirs, well irrigation projects and diversion dams under the Federal reclamation laws.	Mr. Ferguson	Mar. 30, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 5998 (see references under H. R. 2512).	To amend the Flood Control Act of 1936 to provide for the construction of small reservoirs on public and private property.	do	do	Referred to Committee on Flood Control.
H. R. 6091 (see also S. 198)	To provide for a preliminary examination and survey to determine the feasibility and cost of diverting the surplus waters of the Green River, Wyo., to the Bear River for the purpose of irrigating the lands in the Bear River Basin.	Mr. Clark	Apr. 2, 1937	Referred to Committee on Irrigation and Reclamation

Number	Title	Author	Date introduced	Action
H. R. 6094	Authorizing preliminary examinations and surveys of Cherry Creek and its tributaries, and the watershed thereof, in the State of Colorado, for flood control, for run-off and water-flow retardation, and for soil-erosion prevention.	Mr. Lewis	Apr. 2, 1937	Referred to Committee on Flood Control.
H. R. 6103 (see references under H. R. 295).	Amending the Civil Service Retirement Act	Mr. O'Toole	do	Referred to Committee on Civil Service.
H. R. 6146 (see also H. R. 7680, S. 2086).	To authorize appropriations for the construction of the Arch Hurley conservancy district in New Mexico.	Mr. Dempsey	Apr. 5, 1937	Referred to Committee on Irrigation and Reclamation
H. R. 6151 (see references under H. R. 4948).	To authorize the completion, maintenance, and operation of the Bonneville project for navigation, and for other purposes.	Mrs. Honeyman	do	Referred to Committee on Rivers and Harbors.
H. R. 6180 (see references under H. R. 4481).	To establish a Civilian Conservation Corps, and for other purposes.	Mr. Connery	Apr. 6, 1937	Referred to Committee on Labor.
H. R. 6210 (see also H. R. 3035).	To amend an act entitled "An act for the relief of unemployment through the performance of useful public works, and for other purposes", approved Mar. 31, 1933, as extended by the Emergency Relief Appropriation Act of 1935.	Mr. Bernard	Apr. 7, 1937	Do.
H. R. 6319 (see also S. 2172)	To prevent speculation in lands in the Columbia Basin prospectively irrigable by reason of the construction of the Grand Coulee Dam project and to aid actual settlers in securing such lands at the fair appraised value thereof as arid land, and for other purposes.	Mr. Leavy	Apr. 12, 1937	Similar Senate bill S. 2172 substituted and passed by House May 17, 1937.
H. R. 6387 (see references under H. R. 4948).	To authorize the completion, maintenance, and operation of the Bonneville project for navigation and flood control, and for other purposes.	Mr. Pierce	Apr. 14, 1937	Referred to Committee on Rivers and Harbors.
H. R. 6523	Making appropriations for the Department of Agriculture and for the Farm Credit Administration for the fiscal year ending June 30, 1938, and for other purposes.	Mr. Cannon	Apr. 20, 1937	Approved by President June 29, 1937. Public, No. 173.
H. R. 6551 (see references under H. R. 4481).	To establish a Civilian Conservation Corps, and for other purposes.	Mr. Connery	Apr. 21, 1937	Approved by President June 28, 1937. Public, No. 163.
H. R. 6556 (see references under H. R. 273).	To amend the act of Mar. 4, 1923, entitled, "An act to provide for the classification of civilian positions within the District of Columbia and within the field services, and amendments thereto."	Mr. Randolph	do	Referred to Committee on Civil Service.
H. R. 6564 (see references under H. R. 295).	To amend the act entitled "An act for the retirement of employees in the classified civil service, and for other purposes," approved May 22, 1920, and acts in amendment thereof, approved July 3, 1926, and May 29, 1930, as amended.	Mr. Sirovich	Apr. 21, 1937	Do.
H. R. 6591	To exempt from cancelation certain desert-land entries in Riverside County, Calif.	Mr. Sheppard	Apr. 22, 1937	Referred to Committee on Public Lands.
H. R. 6635 (see also S. 2584)	To dispense with the necessity for insurance by the Government against loss or damage to valuables in shipment, and for other purposes.	Mr. Cochran	Apr. 23, 1937	Approved by the President July 8, 1937. Public, No. 192.
H. R. 6771 (see H. R. 209 and S. 2309).	Regulating the traveling allowance of civilian officers and employees, and for other purposes.	Mr. Disney	Apr. 29, 1937	Referred to Committee on Expenditures in the Executive Departments.
H. R. 6930	Authorizing an investigation of the Yellowstone River in Montana by the Bureau of Reclamation for the purpose of irrigation, flood control, power, and for other purposes.	Mr. O'Connor	May 10, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 6958	Making appropriations for the Department of the Interior for fiscal year ending June 30, 1938, and for other purposes.	Mr. Taylor	May 11, 1937	Approved by the President Aug. 9, 1937. Public, No. 249.
H. R. 6973 (see references under H. R. 4948).	To authorize the completion, maintenance, and operation of Bonneville project for navigation, and for other purposes.	Mr. Mott	do	Referred to Committee on Rivers and Harbors
H. R. 7010 (see references under H. R. 4948).	To authorize the completion, maintenance, and operation of the Bonneville project for navigation, and for other purposes.	Mr. Mott	May 12, 1937	Do.
H. R. 7024	To create the National Natural Resources Corporation, and for other purposes.	Mr. Coffee	May 13, 1937	Referred to Committee on Ways and Means.
H. R. 7051 (see also H. R. 1529, H. R. 7646, H. R. 7774, H. R. 8144).	Authorizing the construction, repair, and preservation of certain public works on rivers and harbors and for other purposes.	Mr. Mansfield	May 14, 1937	Approved by President Aug. 26, 1937. Public, No. 392.
H. R. 7091	To give the consent and approval of Congress to the extension of the terms and provisions of the present Rio Grande compact signed at Santa Fe, N. Mex., on Feb. 12, 1929, and heretofore approved by act of Congress dated June 17, 1930 (Public, No. 370, 71st Cong.).	Mr. Martin	May 17, 1937	Passed by House May 19, 1937. Referred to Senate Committee on Irrigation and Reclamation May 20, 1937.
H. R. 7131	To establish an office of motion pictures in the Government Printing Office, and for other purposes.	Mr. Schulte	May 19, 1937	Referred to Committee on Printing.
H. R. 7208	To authorize the construction of levees and the dredging of channels in the Yolo bypass area, Sacramento River Basin, State of California.	Mr. Voorhis	May 24, 1937	Referred to Committee on Rivers and Harbors.
H. R. 7237 (see references under H. R. 258).	To create a United States Civil Service Board of Appeals	Mr. Barry	May 25, 1937	Referred to Committee on Civil Service.
H. R. 7264	To revise the boundary of the Grand Canyon National Park in the State of Arizona, to abolish the Grand Canyon National Monument, to restore certain lands to the public domain, and for other purposes.	Mr. Murdock	May 27, 1937	Reported from Committee on Public Lands July 21, 1937.
H. R. 7313	To authorize appropriations for the construction of the Gallatin Valley Dam in Gallatin County, Mont.	Mr. O'Connell	May 28, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 7319 (see references under H. R. 4791).	To continue the Federal Emergency Administration of Public Works for 2 years and to appropriate and reappropriate funds for continuing its activities.	Mr. Beiter	June 1, 1937	Referred to Committee on Appropriations.
H. R. 7321 (see references under H. R. 295).	To amend the Civil Service Retirement Act	Mr. Celler	do	Referred to Committee on Civil Service.
H. R. 7326	To authorize a preliminary examination and survey of the Bill Williams River, in Arizona, with a view to the control of its floods, and for other purposes.	Mr. Murdock	do	Referred to Committee on Flood Control.
H. R. 7327	To authorize a preliminary examination and survey of the Big Sandy River, in Arizona, from the junction of Trout Creek and Knight Creek on the north, to the Bill Williams River on the south, with a view to the control of its floods, and for other purposes.	do	do	Do.
H. R. 7363 (see references under H. R. 4791).	To continue the Federal Emergency Administration of Public Works for 2 years and for other purposes.	Mr. Woodrum	June 3, 1937	Passed by House June 7, 1937. Referred to Senate Committee on Appropriations June 8, 1937.
H. R. 7365 (see also H. R. 7392, H. R. 7863, H. Doc. 261, S. 2555).	To provide for the regional conservation and development of the national resources, and for other purposes.	Mr. Mansfield	do	Referred to Committee on Rivers and Harbors.
H. R. 7392 (see references under H. R. 7365).	To provide for the creation of conservation authorities, and for other purposes.	Mr. Rankin	June 4, 1937	Do.
H. R. 7394	To authorize projects for the conservation of water in the Great Plains.	Mr. Jones	do	Referred to Committee on Agriculture.
H. R. 7450	To authorize the sale of part of the lands belonging to the Palm Springs or Agua Caliente Band of Mission Indians, and for other purposes.	Mr. Rogers	June 9, 1937	Referred to Committee on Indian Affairs.

Number	Title	Author	Date introduced	Action
H. R. 7453	To provide for the development, safeguarding, and improvement of navigation on Ouachita River and its tributaries; for control and prevention of floods; use and reclamation of public lands; regulation of commerce among the States; conservation of water, soil, and forest resources of the Nation; for stabilizing employment and relieving unemployment; for agricultural and industrial development; for irrigation of lands; for restoration and preservation of water level; for development of electrical power for public use; and to provide for national defense and promote general welfare.	Mr. Kitchens	June 9, 1937	Referred to Committee on Rivers and Harbors.
H. R. 7504	To provide for the disposition of certain records of the United States Government.	Mr. Colden	June 14, 1937	Referred to Committee on Disposition of Executive Papers.
H. R. 7513 (see also S. 2583)	To provide for the acquisition of certain lands for and the addition thereof to the Tahoe National Forest, in the State of Nevada, and for other purposes.	Mr. Scrugham	do	Referred to Committee on the Public Lands.
H. R. 7529 (see references under H. R. 7051).	Authorizing the construction of certain public works on rivers and harbors for flood control, and for other purposes.	Mr. Miller	June 15, 1937	Referred to Committee on Flood Control.
H. R. 7556 (see also H. R. 7810).	To provide for the right of election by employees, subject to the provisions of the Civil Service Retirement Act, of a joint and survivorship annuity upon retirement.	Mr. Ramspeck	June 17, 1937	Referred to Committee on the Civil Service.
H. R. 7562 (see references under H. R. 8).	To encourage and promote the ownership of farm homes and to make the possession of such homes more secure, to provide for the general welfare of the United States, to provide additional credit facilities for agricultural development, and for other purposes.	Mr. Jones	do	Approved by President July 22, 1937. Public, No. 210.
H. R. 7567 (see also S. 2980)	To authorize the Secretary of the Interior to permit the payment of the costs of repairs, resurfacing, improvement, and enlargement of the Arrowrock Dam in 20 annual installments, and for other purposes	Mr. White	do	Reported from Committee on Irrigation and Reclamation July 28, 1937.
H. R. 7578 (see also S. 2682)	To authorize the Secretary of the Interior to issue patents to States under the provisions of section 8 of the act of June 28, 1934 (48 Stat. 1269), as amended by the act of June 26, 1936 (49 Stat. 1976), subject to prior leases issued under section 15 of said act.	Mr. Greever	June 18, 1937	Referred to Committee on the Public Lands.
H. R. 7596	To authorize a preliminary examination and survey of the Neosho River and its tributaries in the States of Kansas and Oklahoma, with a view to the control of its floods.	Mr. Disney	June 21, 1937	Referred to Committee on Flood Control.
H. R. 7610 (see also S. 708)	Granting an increase in compensation to William B. Lancaster.	Mr. Robinson	do	Referred to Committee on Claims.
H. R. 7625	To regulate the hours of work and the workweek in civilian branches of the Federal Government, and for other purposes.	Mr. Dunn	June 22, 1937	Referred to Committee on Civil Service.
H. R. 7642 (see references under H. R. 4948).	To authorize the completion, maintenance, and operation of Bonneville project for navigation, and for other purposes.	Mr. Mansfield	June 23, 1937	Approved by President Aug. 20, 1937. Public, No. 329.
H. R. 7646 (see references under H. R. 7051).	To amend an act entitled "An act authorizing the construction of certain public works on rivers and harbors for flood control, and for other purposes", approved June 22, 1936.	Mr. Whittington	do	Approved by President Aug. 28, 1937. Public, No. 406.
H. R. 7680 (see also H. R. 6146, S. 2086).	To authorize the construction of a Federal reclamation project to furnish a water supply for the lands of the Arch Hurley conservancy district in New Mexico.	Mr. Dempsey	June 28, 1937	Laid on table. S. 2086 passed by House July 21, 1937.
H. R. 7681 (see also S. 2670)	To provide that the United States shall aid the States in wildlife-restoration projects, and for other purposes.	Mr. Robertson	do	Referred to Committee on Agriculture.
H. R. 7697 (see also S. 2863)	To promote conservation in the arid and semiarid areas of the United States by aiding in the development of facilities for water storage and utilization, and for other purposes.	Mr. Jones	do	Independently postponed. House passed S. 2863 on Aug. 20, 1937.
H. R. 7726 (see also H. R. 7865).	Appropriations for the first half of July 1937 for certain operations of the Federal Government.	Mr. Cannon	June 29, 1937	Approved by the President July 1, 1937. Public, No. 177.
H. R. 7740 (see references under H. R. 273).	To amend the Classification Act of 1923 (Public, No. 516, 67th Cong.) as amended.	Mr. Ramspeck	July 1, 1937	Referred to Committee on the Civil Service.
H. R. 7764	To authorize the sale of surplus power developed under the Uncompahgre Valley reclamation project, Colorado.	Mr. Taylor	July 6, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 7774 (see references under H. R. 7051).	To amend an act entitled "An act authorizing the construction of certain public works on rivers and harbors for flood control, and for other purposes", approved June 22, 1936.	Mr. Ford	July 8, 1937	Referred to Committee on Flood Control.
H. R. 7802	To provide for the promotion of the efficient and equitable use and effective control and conservation of the water resources of the United States for the greater good of the people, and for other purposes.	Mr. O'Neal	July 9, 1937	Referred to Committee on Rivers and Harbors.
H. R. 7810 (see also H. R. 7556).	To amend the Civil Service Retirement Act	Mr. Beiter	do	Referred to Committee on the Civil Service.
H. R. 7825	To authorize the use of certain facilities of national parks and national monuments for elementary-school purposes.	Mr. DeRouen	July 12, 1937	Reported from Committee on Public Lands July 21, 1937.
H. R. 7831	To prevent interference with Government employees and officials and the transaction of Government business.	Mr. Hoffman	do	Referred to Committee on Judiciary July 12, 1937.
H. R. 7863 (see references under H. R. 7365).	To provide for the creation of conservation authorities, and for other purposes.	Mr. Rankin	July 14, 1937	Referred to Committee on Rivers and Harbors.
H. R. 7865 (see also H. R. 7726).	Making appropriations for certain necessary operations of the Federal Government for the last half of the month of July 1937.	Mr. Cannon	July 14, 1937	Approved by the President July 16, 1937. Public, No. 207.
H. R. 7937 (see also H. R. 7953, S. 2821).	To provide for studies and plans for the development of reclamation projects on the North Canadian River in Oklahoma.	Mr. Ferguson	July 20, 1937	Referred to Committee on Irrigation and Reclamation.
H. R. 7938 (see also H. R. 7953, S. 2821).	To provide for studies and plans for the development of reclamation projects on the Washita River in Oklahoma.	do	do	Do.
H. R. 7953 (see references under H. R. 5960, H. R. 7937, H. R. 7938).	To provide for studies and plans for the development of reclamation projects on the Cimarron River in Cimarron County, Okla.; the Washita River in Oklahoma; and the North Canadian River in Oklahoma.	do	July 21, 1937	Approved by the President Aug. 19, 1937. Public, No 321.
H. R. 7954 (see references under H. R. 5960).	To provide for studies and plans for the development of reclamation projects on the Cimarron River in Cimarron County, Okla.	do	do	Referred to Committee on Irrigation and Reclamation.
H. R. 7958	Regulating the selection of materials to be used in buildings erected on Government property.	Mr. Whelchel	do	Referred to Committee on Public Buildings and Grounds.
H. R. 8008	To provide for the purchase of public lands for home and other sites.	Mr. Izac	July 26, 1937	Referred to Committee on Public Lands.
H. R. 8026 (see also S. 2888, H. R. 7450).	To authorize the Secretary of the Interior to lease or sell certain lands of the Agua Caliente or Palm Springs Reservation, Calif., for public airport use, and for other purposes.	Mr. Sheppard	July 27, 1937	Referred to Committee on Indian Affairs.
H. R 8043 (see also S. 1570)	Authorizing and consenting to an interstate compact between the States of Minnesota, South Dakota, and North Dakota, relating to the utilization of, the control of the floods of, and the prevention of the pollution of, the waters of the Red River of the North and streams tributary thereto.	Mr. Lemke	July 28, 1937	Referred to Committee on Flood Control.

Number	Title	Author	Date introduced	Action
H. R. 8048 (see references under H. R. 1590).	Relating to the eligibility of certain persons for admission to the civil service.	Mr. O'Neill	July 28, 1937	Referred to Committee on Civil Service.
H. R. 8064 (see also S. 2926)	To amend sec. 13 of the Classification Act of 1923, as amended	Mr. Ramspeck	July 29, 1937	Do.
H. R. 8065 (see references under H. R. 295).	To provide for the retirement of certain employees of the U. S. Government, for the payment of annuities, and for other purposes.	do	do	Do.
H. R. 8144 (see references under H. R. 7051).	To amend the act entitled "An act authorizing the construction of certain public works on rivers and harbors for flood control, and for other purposes", approved June 22, 1936.	Mr. Gray	Aug. 4, 1937	Referred to Committee on Flood Control.
H. R. 8188 (see also S. 2614)	Authorizing the Secretary of the Interior to patent certain tracts of land to the State of New Mexico and Cordy Bramblet.	Mr. Dempsey	Aug. 9, 1937	Referred to Committee on Public Lands.
H. R. 8189 (see also H. R. 8188, S. 2614).	Authorizing the Secretary of the Interior to convey all right, title, and interest of the United States in certain lands to the State of New Mexico, and for other purposes.	do	do	Do.
H. R. 8202 (see references under H. R. 67).	To provide for the reorganization of agencies of the Government, to establish the Department of Welfare, and for other purposes.	Mr. Warren	Aug. 10, 1937	Passed by House Aug. 13, 1937. Referred to Senate Select Committee on Government Orgauization Aug. 14, 1937.
H. Res. 9	Providing for the appointment of a select committee authorized and directed to investigate the distribution of appointments of present officers and employees in the executive branch of the Government, whether under civil service or otherwise.	Mr. Lamneck	Jan. 5, 1937	Referred to Committee on Rules.
H. Res 95	To create a select committee to investigate flood projects	Mr. O'Malley	Jan. 29, 1937	Do.
H. Res. 161 (see also H. R 4269, S. 1830).	To make H. R. 4269, a bill to provide for a useful and comprehensive system for the impounding, storing, conserving, and making use of the unappropriated waters falling or emanating within the United States, and for other purposes, a special order of business.	Mr. Harrington	Mar. 23, 1937	Do.
H. J. Res. 27	Providing for a national moratorium in the drought area of the United States	Mr. Burdick	Jan. 5, 1937	Referred to Committee on Agriculture.
H. J. Res. 81 (see references under H. R. 67).	To create a joint congressional committee on Government organization.	Mr. Buchanan	Jan. 6, 1937	Approved by President Feb. 3, 1937. Public, No. 4.
H. J. Res. 91 (see also H. J. Res 150, S. J. Res. 12).	To permit a compact or agreement between the States of Idaho and Wyoming respecting the disposition and apportionment of the waters of the Snake River and its tributaries, and for other purposes.	Mr. White	do	Referred to Committee on Irrigation and Reclamation.
H. J. Res. 97 (see also H. R. 3408).	Repealing section 213 of the Legislative Appropriation Act for the fiscal year ending June 30, 1933, relating to the dismissal and appointment of married persons.	Mr. Millard	Jan. 8, 1937	Referred to Committee on Expenditures in the Executive Departments.
H. J. Res 137	To amend a Senate joint resolution dated Mar. 28, 1918 (40 Stat. 499) (relating to signing of papers).	Mr. DeRouen	Jan. 21, 1937	Passed by House Mar. 10, 1937. Referred to Senate Committee on Public Lands and Surveys Mar. 11, 1937.
H. J. Res. 150 (see also H. J. Res. 91, S. J. Res. 12).	To permit a compact or agreement between the States of Idaho and Wyoming respecting the disposition and apportionment of the waters of the Snake River and its tributaries, and for other purposes.	Mr Clark	Jan. 25, 1937	Passed by House Apr 5, 1937. Referred to Senate Committee on Irrigation and Reclamation Apr. 7, 1937.
H. J. Res. 175 (see also S. J. Res. 57).	To authorize the submission to Congress of a comprehensive national plan for the prevention and control of floods of all the major rivers of the United States, and for other purposes.	Mr. McClellan	Jan. 29, 1937	S. J. Res. 57 substituted and passed by House July 29, 1937.
H. J. Res. 314 (see also S. J. Res. 88).	Providing for the participation of the United States in the exposition to be held by the San Francisco Bay Exposition, Inc., sponsors for the Golden Gate International Exposition, in the city of San Francisco during the year 1939, and for other purposes.	Mr. Welch	Mar. 6, 1937	Referred to Committee on Foreign Affairs.
H. J. Res. 338 (see also H. J. Res. 345, H. Con. Res. 11, S. J. Res. 142).	Authorizing the President to reduce appropriations for fiscal year 1938 10 percent	Mr. Taber	Apr. 23, 1937	Referred to Committee on Appropriations.
H. J. Res. 345 (see references under H. J. Res. 338).	Impounding 15 percent of appropriations made available for obligation for the fiscal year 1938, subject to release by the President.	Mr. Cannon	Apr. 27, 1937	Do.
H. J. Res. 361 (see references under H. R. 155).	Making appropriations for relief purposes	Mr. Woodrum	May 12, 1937	Approved by the President June 29, 1937. Public Resolution No. 47.
H. J. Res. 379	Authorizing Federal participation in the New York World's Fair 1939.	Mr. Merritt	May 24, 1937	Approved by the President July 9, 1937. Public Resolution No. 53.
H. J. Res. 433	Making appropriations for the fiscal year ending June 30, 1938, for the Civilian Conservation Corps, the railroad retirement account, and other activities, and for other purposes.	Mr. Woodrum	June 29, 1937	Approved by the President July 1, 1937. Public Resolution No. 50.
H. J. Res. 453	To determine the nature and effect of economic conditions or statutory provisions tending to produce unfair or inequitable discrimination on the basis of age in obtaining and retaining employment in public service and private industry.	Mr. Mead	July 22, 1937	Referred to Committee on Labor.
H J. Res. 458 (see also H. J. Res. 465, S. J Res. 186).	Providing for the participation of the United States in the continuing international exposition to be known as Pacific Mercado, to be held in the city of Los Angeles, Calif., commencing in the year 1940 and in the year 1942, commemorating the landing of Cabrillo, and for other reasons.	Mr. Ford	July 26, 1937	Referred to Committee on Foreign Affairs.
H. J. Res. 465 (see also H. J. Res. 458, S. J. Res. 186).	Providing for the participation of the United States in the continuing international exposition, to be known as Pacific Mercado, to be held in the city of Los Angeles, Calif., commencing in the year 1940, and in the year 1942 commemorating the landing of Cabrillo, and for other purposes.	Mr. Kramer	July 29, 1937	Do.
H. Con. Res. 11 (see references under H. J. Res. 338).	Requesting the President of the United States to submit for the consideration of Congress a revised program of appropriations and expenditures in order to effect a balanced budget for the fiscal year ending June 30, 1938.	Mr. Taber	Apr. 27, 1937	Referred to Committee on Appropriations.
H. Doc. No. 13	Reports to be made to Congress		Jan. 5, 1937	Referred to Committee on Accounts.
H. Doc. 114	Estimate of appropriations to pay claims for damage to privately-owned property.		Jan. 13, 1937	Referred to Committee on Appropriations.
H. Doc. 140	Public Works Planning—Report of National Resources Committee.		Feb. 3, 1937	Referred to Committee on Education and Labor.
H. Doc. 141	Report of Great Plains Committee		Feb. 10, 1937	Referred to Committee on Agriculture.
H. Doc. 196 (see references under H. R. 4481).	Permanent establishment of Civilian Conservation Corps		Apr. 5, 1937	Referred to Committee on Education and Labor.
H. Doc. 234	Work relief, fiscal year 1938—President's message		Apr. 20, 1937	Referred to Committee on Appropriations.
H. Doc. 261 (see references under H. R. 7365).	Flood prevention and drought emergencies—National Planning Board.		June 3, 1937	Referred to Committee on Rivers and Harbors.

Keeping Up with the Times

By Elizabeth Butler Loosley, Klamath Falls, Oreg.

AS EARLY as 1905 irrigation had assumed such proportions that Klamath Falls, Oreg., was feeling its influence and the women realized they had adverse conditions with which to cope.

By this is meant that the town had gone through all the growing pains experienced by a western town in its various phases of development, to attain its present status, the one store a hang-out for the Indians who roamed, the one rutted street lined with hitching racks, and a few cowboys and soldiers loitering about. Settlers increased when the soldiers came to give them protection from the Indians, several shacks and tents were erected, and a few more saloons and "joints" were added as a wagon road, bridges, telephone lines, and finally a power line, came. In the early 1900's irrigation was established on a solid footing, and immediately, seemingly overnight, a multiplication of everything appeared, and with this growth, a railroad. At that time a writer of fiction would have found atmosphere aplenty, as every known device to separate a dirt mover from his cash was thriving.

To counteract these conditions the Klamath Falls city library came into prominence in 1905 and was maintained by a group of women until 1912, when it was turned over to the city.

WOMEN'S LIBRARY CLUB

In 1925 the city voted $50,000 for the building of a library to have clubrooms adequate for all the women's clubs. Mr. Fred Shallock and Mrs. Claud Daggett, his sister, presented a lot in memory of their mother, one of the original instigators of the first women's club, for the site, and the building was erected. The city council voted $8,000 for its support and founded a budget upon this sum. At last all the worth-while properties of the old library were moved into the new building and the women who had labored so earnestly were repaid.

Later the Rotary Club donated a collection to the children's room and each year they add several hundred of the best and most exquisitely illustrated editions to be found. The Women's Library Club makes a gift each year, such as a picture or a piece of pottery.

Today the library, of which Miss Enola A. Hawkins is the able librarian, has more than 13,000 volumes and its circulation is 85,256—all because our pioneer women saw the need for a cultured community.

In the main entrance is a bronze plaque bearing the name of the donor of the location, Mrs. Fred Melhase (nee Shallock), and this is fitting as she worked and encouraged others so that the institution might be possible.

The basement contains spacious rooms where each month the Women's Library Club holds its regular monthly meetings at which something worth-while is offered, such as a reading of Green Pastures by outside talent. At one of the meetings Ann Shannon Monroe, Oregon authoress, appeared and gave a talk, and at another Nelson Eddy entranced an audience. Although the Library Club was largely instrumental in bringing Mr. Nelson to Klamath Falls, the support of musical circles was obtained and a more spacious auditorium had to be used. The flower shows also are held here but they are of such importance that they deserve a special write-up. The club rooms are open to the Business Women's Club and any other worth-while organization.

THE KLAMATH COUNTY LIBRARY SERVES SCHOOLS

Irrigation has made great strides in the Klamath project and so have the activities of the women; and in order to meet the demands another library came into being, the Klamath County Library of which Miss Mary L. McComb is the efficient librarian. The library contains 21,000 volumes, has 24 branch stations in the communities for adults and children, 40 school branches and an average of 2 trips a week are made to branches and stations and 2 trips per week to schools during the school term. The branches range from the largest at Chiloquin, with a permanent collection of 1,800 volumes, and a circulation last year of 18,634, to small stations maintained in a post office or store with as few as 50 books, as at Hildebrand.

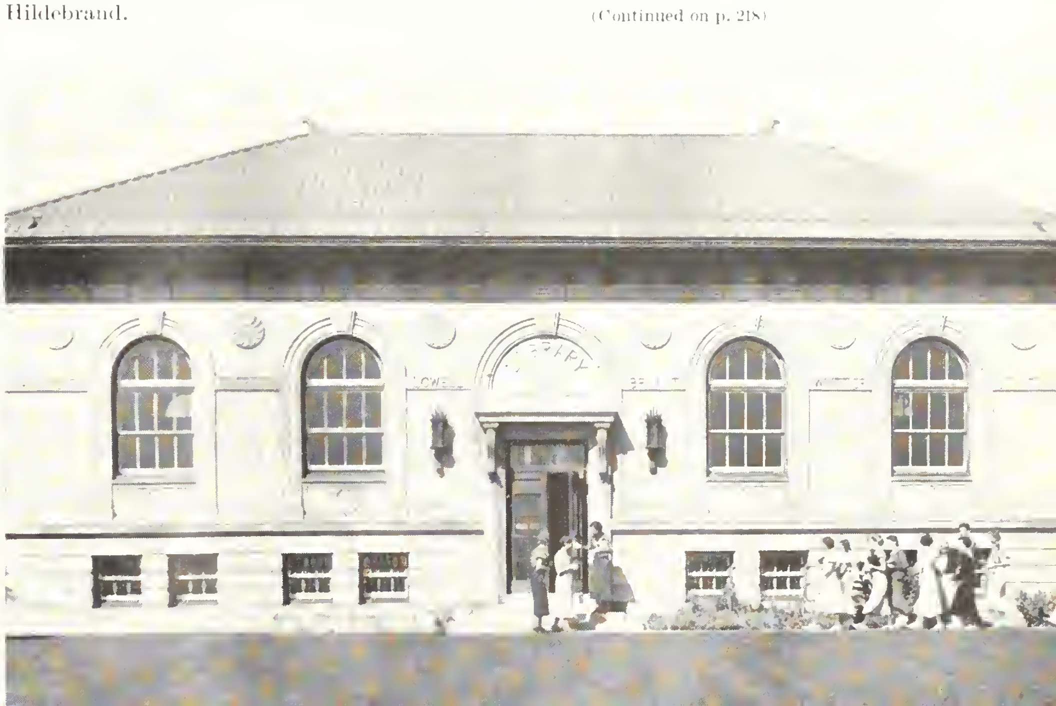
The schools of the county have 3,504 pupils who are using books from the school branches; the students of Klamath Union High School, with an enrollment of more than 1,000, come over during each period to do reference work. This is made possible by its location, as the high school is less than 75 feet from the library and the entire school library is maintained here.

If a school or branch or individual cannot be reached, the needs are supplied by mail. Twelve such packages go out each week; collections are placed in CCC camps and these are appreciated and used. The library also acts as a clearing house for old magazines.

In making trips with the van to isolated spots and schools it is enlightening and a delight to see the groups awaiting its arrival. The writer has seen a tiny Indian child who could not read but chose a picture book and hurriedly began turning the pages with sticky little fingers; mothers asking for Ann Lindbergh's North to the Orient, a book on menus, decoration, and the home; the young farmer with his demands on stock breeding; some who may be taking reading courses; and others who are interested in mystery stories, and so on, and the van never fails them.

If you want to observe humanity at its best seat yourself in the City Library and watch the children in their special room, watch the factory and mill workers from the anemic to the burly type, the busy housewife snatching a few minutes to make selections for herself and family, the staid business man looking for statistics, the teacher, a writer studying the lot as he browses among the early histories, and the itinerant reading the want ads in the daily paper, not to mention the contest fiends who are searching Roget's

(Continued on p. 218)



HIGH SCHOOL STUDENTS ON WAY TO KLAMATH COUNTY LIBRARY.

Lettuce Fertilization Experiments in Valley Division, Yuma Project

By G. E. Blackledge, Yuma County Agricultural Agent

A SERIES of lettuce fertilization tests has been conducted in the Valley Division of the Yuma project during the past 3 years. M. F. Wharton, Associate Horticulturist of the University of Arizona, directly supervised this work, which was carried out in cooperation with E. M. McDaniels & Son, Harley Harmon, and the L. M. McLaren Produce, Inc., extensive growers and packers of winter vegetables in the Yuma project.

The plots used in all the experiments were located in fields that had not been previously fertilized and were considered only average lettuce land. The fertilizer was applied with commercial equipment and, in most cases, according to the prevalent method in the district. Fertilizers applied ahead of planting were broadcast and disced. Side dressings were applied to the bottom of the furrow, then cultivated to thoroughly mix with the soil, and the mixture was thrown to the sides by a furrow-out shovel to prevent excessive downward leaching from irrigation.

Where ammonium gas was used, the fertilizer was applied to the irrigation water. Side dressings were applied just after thinning except where the series applications were used. In this case, one-half or one-third of the total amount was applied just following thinning, and the remaining applications were put on at monthly intervals.

ORDERLY FERTILIZATION

The conclusions which may be drawn from this 3-year period of lettuce fertilization work in the Yuma Valley may be of some help to lettuce growers. It was conclusively demonstrated that all lettuce soils are deficient in phosphates and every lettuce crop is benefited by phosphate fertilizer applications. The most economical application of phosphate fertilizers appeared to be an application prior to the seeding of the crop. The beneficial effect of phosphates is greatly enhanced by the addition of nitrogen. Organic nitrogens should be used before planting and inorganic nitrogens will give the best results when used as side dressings when following an initial application of phosphates. Organic nitrogen and phosphates are most efficient when applied to a depth of 3 to 4 inches in ribbons before seeding. Nitrate side dressings increase the efficiency if the total amount is applied in several applications rather than all at one time. Thus nitrogen-bearing fertilizers requiring decomposition before becoming usable to the plant must be applied at a time when the soil is warm, in order to develop their maximum effect. They are not favored for side dressings, or for fertilization at a time when cold weather is near. A time interval of 4 to 6 weeks is needed under soil temperature above 60° to convert organic fertilizers into usable plant food.

A conservative program of lettuce fertilization which may be varied in amounts in accordance with the natural fertility of the soil is suggested by Professor Wharton. For fall lettuce, apply 200 pounds of superphosphate mixed with 300 pounds of inorganic nitrogen material, using the drill method of application. This should be applied about 2 weeks before planting.

For spring lettuce an initial application of 400 pounds of superphosphate and 500 pounds of organic nitrogen applied 4 weeks before planting is best. If organic nitrogen is not used with the superphosphate, then increase the phosphate by 100 pounds in each case and use calcium nitrate or sodium nitrate as a side dressing, in 100 pounds per acre applications 1 month apart, starting just after thinning and continuing as long as is needed to produce the desired growth.

When phosphate alone is used or when desired results from phosphate and organic nitrogen applied before seeding are not obtained, due to inclement weather or other causes, calcium nitrate or sodium nitrate in 100 pound per acre applications as needed will give the desired growth.

Ammonia gas in 20- to 30-pound per acre applications as the crop nears maturity will give the desired increase in the size of the head.

FERTILIZED LETTUCE ON LEFT; UNFERTILIZED ON RIGHT.

Yuma to Have New Cannery and Citrus Juicing Plant

Excavation work on the new cannery and citrus juicing plant of the Yuma Mesa Fruit Growers' Association, part of an ultimate $25,000 construction program, was started on July 30 on grounds adjacent to the present citrus packing house. The cannery unit is designed for subsequent expansion, if necessary. The plant, although owned by the local grapefruit growers and designed especially to handle citrus, will be prepared to can other fruits and vegetables should the occasion for such use develop later. The cannery will have a seasonal capacity of 160,000 cases of no. 2 size cans.

HARVESTING of cantaloups on the Yuma project, Arizona-California, began early in June. A steady market, with remunerative prices and favorable growing weather, combined to make this what may be one of the most profitable seasons for the growers. During that month 697 carloads of cantaloups were shipped to market from Yuma by rail.

Milk River Project Indians

By Seth H. Dibble, Assistant Clerk, Milk River Project

THE genesis of the American Indian is a matter of conjecture and genealogists differ in their opinions. Some say they are the progeny of a single aboriginal stock. Others claim they are descendants of the 10 lost tribes of Israel. Suffice it to say that they were the early inhabitants of America, and that they lived and loved and fought and died as other human beings.

The explorers, Lewis and Clark, constantly contacted tribe after tribe on their trail of discovery. Had they erred in their judgment and continued up the Milk River, when they had arrived at its influx with the Missouri in Montana, they would have found such tribes as the Sioux, Assiniboines, Gros Ventres, and Blackfeet.

Eastern Montana, particularly, was a buffalo country, and buffalo furnished food, clothing, and lodges. These immense prairie animals, now almost extinct, fed in vast herds on the short, curly prairie grass to the north and south of the Milk in the summer, and munched the tender willows that fringed the river bottoms in the winter. So what is now the Milk River project had been for numberless years the home of the red man. The waters of its river have mirrored countless hideously painted faces, framed in feathered war bonnets, as they prepared to expel other poaching tribes from their hunting grounds. Here and there along its banks, cottonwood trees still cradle their bundled dead. The native grasses of its now civilized acres once grew rank on the blood of battle.

The badland breaks of the Missouri, a short distance to the south, also heard the twang of the bow and the whiz of the arrow, as Indians forced the herd over some precipice, or fought their enemy in deadly strife.

THE MISSOURI RIVER BREAKS

Throughout thousands of years of patient labor, Nature has carved, with awful grandeur, the Montana breaks of the mighty Missouri. With erosion serving as both chisel and mallet, she has fashioned the towers and turrets and graceful domes of majestic cathedrals. Fretting with frost and snow and rain and hail, she has gargoyled their eaves with impervious stone. Her colorings have been dipped from the paint pots of the Arctic; red and green, black and gray, yellow and orange, with distance adding mauve and pink and multi-shades of blue. The dripping edge of a moraine-covered glacier, like the drooling lip of an angry monster, began these carvings, and the elements have continued the work.

Standing on the border of a sweeping prairie, whose ragged edges form these breaks, one looks down through scattering pines and firs, through Spanish bayonet, sage, and bunchgrass, to catch glimpses of shimmering waters, where Cow Creek spews its bitterly alkaline accretions into the river far below. Some 25 miles north, two small mountain ranges, the Little Rockies and the Bear's Paw, stand side by side, as though lost from the rest of the world's upheavals. Their water courses to the Missouri on the south and the Milk River on the north are deep cuts in the glacial soil. It was in one of these same northern erosions that Joseph, chief of the Nez Perce Indians, made his last stand.

CHIEF JOSEPH'S LAST BATTLE

The "Pierced Noses" lived in the mountainous country north of Idaho, and hunted bear, deer, elk, and beaver for food and clothing, as had their ancestors for hundreds of years. There were no buffalo in their country. They wore soft-soled moccasins, the better to stalk their wary game with noiseless stealth. Their neighbors on the prairies east of the Rockies used heavy rawhide soles for protection against cacti, since they depended on the fleetness of their ponies while hunting buffalo. Prior to the advent of horses, they used various ruses to force the herd over some precipice. The Nez Perce Indians had many ponies and they made annual treks across the mountains to barter ponies for buffalo robes; so they were not strangers to these edgeless stretches.

A time came when the Government decided to confine the Indians to stated tracts of land, called reservations. In May 1877 councils were held with the Nez Perce chieftains and June 14 was selected as the date for their migration to the Wallowa Valley.

Sitting Bull had voiced the belief of every Indian, when he said, "God Almightly made them Indians, not agency Indians." The thought of being prisoners in a small valley was inconceivable to Joseph and his tribe. Harried by uncertainties and with the black picture etching deeper and deeper, Chief Joseph gathered together his men, women, and children, with their hundreds of horses and all their belongings, and beat a retreat comparable in sagacity to that of history's greatest general. Although the trail he left could easily be followed, he successfully evaded at least four military commands, while he traveled with enforced slowness for hundreds of miles across mountain passes in Idaho into southeastern Montana; thence north across the Yellowstone, Musselshell, and and Missouri Rivers. When finally overtaken by mounted troops under Colonel Miles, he was, as usual, encamped in an almost perfect setting from a defensive standpoint. He had chosen a kidney-shaped basin of about 6 acres formed by the eccentric meandering of Snake Creek, near the Bear's Paw Mountains.

While their white enemy galloped to the attack, black beady eyes centered sights along muskets, as the Indians waited until they could distinguish officers. Then began a battle that lasted for days. The Indians, shooting through the sagebrush that fringed the deep-cut coulees, sent bullets with deadly precision. Sleet and snow fell. Miles' soldiers were without tents or fire. Their benumbed fingers pulled triggers and fumbled at belts for more ammunition. The sticky gumbo soil, mixed with dead buffalo grass, clung to their feet in ever increasing quantities. All officers but one had been killed or wounded after the first few volleys. Every first sergeant was slain. The Indians commanded the water holes, and at night ate horses, battle killed. Squaws scooped hollows in the dirt floor of their lodges to protect their wounded from cold and shell fire. Soldiers peeked over the adobe rim only to jerk back with bullet pierced hat, or to fall with a bullet through their brains. Thirst added its parching misery to the rain-soaked wounded.

Reenforcements finally arrived and the boom of a 12-pounder, with its death dealing shrapnel, told Joseph that he must fight a losing battle. Twice he offered to surrender with provisos, and twice went back to renew the battle. On October 4, he had but 87 warriors. There were 184 women and 147 children. With morale unshaken by the terrorism of military might, Joseph, homeless, helpless, undone, raised the white flag a third time to save his people from extermination. Always unafraid, shunning atrocities, every inch a fighter, Joseph, a mighty general who had never expected nor given quarter, accepted the yoke of servitude because of his great love for his people.

So the dead were buried, the wounded crudely, painfully transported over the uneven prairies to a river steamer, and Joseph and his tribe shunted to the Wallowa Valley.

INDIAN RESERVATIONS

Thus were the tribes forced to migrate to various reservations. Some tribes were more fortunate than others in these permanent homes selected by the Government. Two of the more unfortunate were the Gros Ventres and Assiniboines. Their allotment, the Fort Belknap Reservation, was a short distance east of the Nez Perce Snake Creek battleground, extend-

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Mead Lake Temperature Measurements

By Ivan E. Houk, Senior Engineer, Technical Studies, Denver, Colorado

LAKE MEAD FROM OBSERVATION POINT.

MEASUREMENTS of water temperature at different depths in Mead Lake, the storage reservoir created by the construction of Boulder Dam, have been made at monthly intervals since early in June 1936. Although the data obtained thus far are not representative of ultimate stable conditions, they show some interesting temperature effects in the various lake strata. This is particularly true for the strata near the bottom of the reservoir, where abnormally high temperatures are being recorded instead of the minimum temperatures usually observed at such locations.

Lake temperatures are measured with an electrical resistance thermometer, lowered from a launch. Observations are made at 5-foot intervals from the surface to a depth of 30 feet, then at 10-foot intervals to a depth of 100 feet, and then at 25-foot intervals to the bottom of the lake. The deepest reading is taken with the thermometer only a foot or two above the bottom. The measurements are made in the canyon near the dam, about midway between the two upstream outlet towers. However, a special set of observations, taken about 4,000 feet upstream from the dam on April 30, 1937, showed practically the same temperature distribution as at the regular observing station.

Temperature conditions in Mead Lake are now in a transitional stage. The reservoir above Boulder Dam is being gradually filled as inflowing Colorado River discharges exceed irrigation and power demands. When the temperature measurements were begun the lake surface was at elevation 998.7, approximately 233 feet below the top of the dam. The water stored at that time was about 385 feet deep and amounted to 8,048,000 acre-feet, or about 26 percent of the total storage capacity. At the end of the first year of temperature measurements, June 1937, the lake surface was at elevation 1,080, the depth was about 465 feet, and the total quantity stored was 13,689,000 acre-feet, or about 45 percent of the total capacity. Consequently, temperature conditions in the major portion of the lake, below a relatively shallow layer near the surface, were largely controlled by inflowing Colorado River temperatures.

GRADUAL DECREASE IN LAKE TEMPERATURES

The effects of river inflows on lake temperatures will gradually decrease as the lake surface approaches the top of the dam. When the reservoir is approximately full, volumes of incoming flood flows will be much smaller percentages of the total lake storage. Furthermore, large portions of the flood inflows will be promptly released through the spillway drum gates or the outlet tower cylinder gates, in order to keep storage space available for controlling subsequent flood flows.

Temperature conditions in the lower portions of the lake are being gradually modified by winter inflows. Colorado River discharges which enter the reservoir during the winter months are much smaller than the flood flows which arrive during the late spring and early summer. Nevertheless, the relatively cold and dense winter run-off goes to the lower lake levels where it gradually accumulates, raising the warmer water to higher levels. This action will continue until the upper limit of the cold water reaches the lower cylinder gates, approximately 280 feet above the lake bed, after which further rising of the cold water will depend on the operation of the gates.

WATER TEMPERATURE VARIATIONS

The first set of temperature observations, made June 10, 1936, showed water temperature increasing gradually from 50° F., at the bottom, to 76° at the surface. During the summer months the temperatures remained approximately the same below elevation 850, about 235 feet above the bottom; but increased gradually between elevation 850 and the lake surface. The surface temperature reached 84° on August 1, 1936, when the water level was at elevation 1,020, or about 405 feet above the bottom. It probably reached higher values on other dates. Since the measurements were only made once a month, the maximum surface temperature probably was not observed.

Relatively warm but abnormally dense river flow, entering the reservoir during the latter part of the summer, increased the lake temperature at strata below elevation 850 to about 60° on September 1 and to about 62° on October 1, except near the bottom where the temperatures were somewhat higher, as discussed later. During the fall months inflowing river water of slowly decreasing temperature, together with vertical lake currents, caused by seasonal cooling and accompanying sinking of surface water, gradually equalized temperature conditions throughout the lake. On December 1 the water temperatures were practically constant from elevation 675 to the surface, elevation 1,024, varying only from 62° at the lower elevation to 63° at the surface. Measurements on January 6 and February 1, 1937, showed slightly lower but similarly uniform temperatures throughout the same range in depth, approximately 57° on the former

date and approximately 53° on the latter.

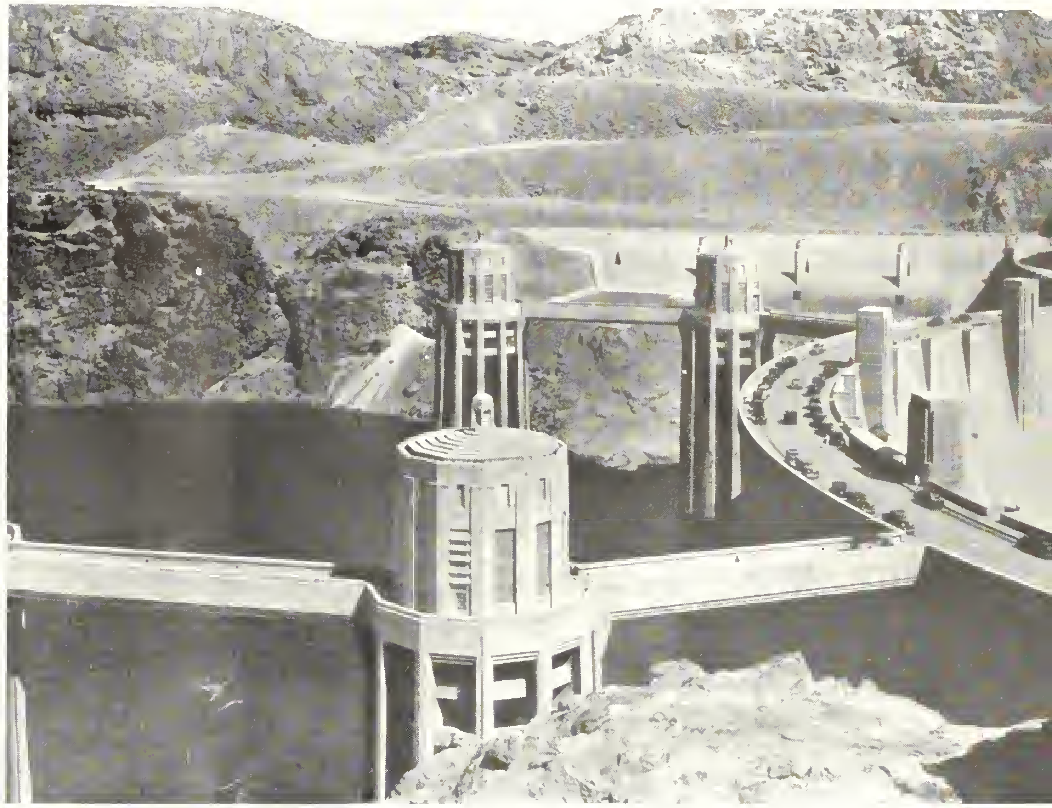
By March 1, 1937, the water temperatures had decreased slightly in the lake strata below elevation 850, and increased slightly in the strata above elevation 850, the temperatures varying gradually from about 47° at elevation 675 to about 56° at the lake surface, elevation 1,026. During the succeeding spring months the temperatures remained about the same below elevation 850 but increased between elevation 850 and the surface, reaching a value of 72° at the surface by June 2, 1937.

Measurements made on September 1, 1936, showed the existence of an abnormally warm strata of lake water near the bottom of the reservoir. Water temperatures increased from 64° at the bottom to 68° at a height of 9 feet above the bottom, remained practically constant to a height of 34 feet, then decreased abruptly to 60° at a height of 59 feet and remained constant at that value up to a total height of about 210 feet. Similar strata of unusually warm water at the bottom of the lake were noted on all succeeding dates of observation. On October 1, 1936, the abnormally warm water extended to a height of about 90 feet above the bottom. At that time the temperature decrease at the upper limit of the warm strata was from 68° to 62°. After October 1 the upper limit of the warm water gradually lowered but the amount of excess temperature increased. On May 21, 1937, the unusually warm water was only about 35 feet deep, but the temperature decrease at the upper limit of the warm strata was from 68° to 49°, a decrease of 19°.

SUSPENDED SILT PRIMARY CAUSE OF HIGH WATER TEMPERATURE AT BASE OF LAKE

Samples of the lake water taken by Construction Engineer Ralph Lowry on May 21, 1937, showed that the occurrence of abnormally warm water near the bottom of the lake is due primarily to the presence of a heavy load of suspended silt. Samples taken just above the strata of unusually high temperature were entirely clear; but those taken within the strata contained so much silt that they had the color and consistency of thick chocolate. Analyses of the samples, made at laboratory temperatures of 74° to 78°, showed an increase in specific gravity of 1.0014 for the clear water to 1.1787 for the silty water.

A small part of the increased specific gravity near the bottom of the lake may be due to an increased salt content. Laboratory measurements of conductivity, which is a rough index of salinity, showed an increase in reciprocal ohms of 0.00140 for the clear samples to 0.00166 for the silty samples. The increased salt content may be due to solution at exposed salt formations in the Virgin Valley portion of the reservoir site, or to the flow of alkaline springs in the bottom of Black Canyon near the site of Boulder Dam. Possibly some salt is derived from both sources. No analyses of the flow from the springs have been made, but deposits at some of the springs in exposed locations below the dam show that the water must be highly alkaline.



TOP OF BOULDER DAM, SHOWING INTAKE TOWERS, SPILLWAY, AND ROAD OUT OF CANYON TO KINGMAN, ARIZ., AT POINT WHERE MONTHLY MEASUREMENTS OF LAKE MEAD ARE MADE.

Inasmuch as the spring water in many cases is unusually warm, some of the increased temperature effects at the bottom of the lake may be directly due to the flow of the springs. Measurements at some of the warmer springs just below the dam show temperatures as high as 138° F. Furthermore, a small portion of the increased temperature effects may be due to flow of heat from the canyon rock formations. Measurements made prior to the construction of the dam showed that mean annual rock temperatures at depths of 5 to 75 feet from the canyon walls are 75° to 80° F. However, it is believed that the increased temperature effects in the lower lake strata are primarily due to the arrival of warm silty water of relatively high density, which has entered the reservoir at locations above the dam and flowed along the bottom of the canyon beneath the body of the lake.

Federal Irrigation Congress to Meet

The Federal Irrigation Congress held its annual meeting at Caldwell, Idaho, September 14. Commissioner Page attended. His address appears on page 197.

THE highest price paid for hogs in recent years on the Minidoka project was that received for 141 head sold at Paul on July 13 for $11.75 per hundredweight. The hogs had a total weight of 27,230 pounds.

WORK was started in July by the National Park Service on the building occupied by the Six Companies Hospital, Boulder City, Nev., which is to be transformed into an administration building. In addition to offices the building will house a geology laboratory and museum.

THE Western Livestock Co. has recently constructed cattle feeding yards near Toppenish, Wash. (Yakima project). It is expected that 7,000 to 8,000 cattle will be fed during the year. The Yakima Valley was chosen for the feed lot location because of the abundance of feed that can be grown cheaply.

Notes for Contractors

Specification no.	Project	Bids opened	Work or material	Low bidder		Bid	Terms	Contract awarded
				Name	Address			
946-D	Upper Snake River, Idaho-Wyo.	July 12	Cascade Creek diversion dam and earthwork and structures on Cascade Creek-Grassy Lake diversion canal.	Bennett and Taylor	Los Angeles, Calif.	$22,311.00		July 27
741	Sun River, Mont.	July 8	Earthwork and structures, Sun River Slope division laterals.	Otis Williams & Co.	Vale, Oreg.	65,773.80		July 30
942-D	Boulder Canyon, Ariz.-Nev.	July 7	Surfacing a portion of Black Canyon Highway and adjacent parking areas.	E. L. Yeager	Riverside, Calif.	44,246.00		Aug. 7
949-D	Sun River, Mont.	July 26	Six 34-foot by 12-foot radial gates and motor-driven hoists for spillway at Gibson Dam.	Lakeside Bridge & Steel Co.	Milwaukee, Wis.	10,369.00	Net	Aug. 12
951-D	Boulder Canyon, Ariz.-Nev.	July 29	2 plate-steel turbine inlet pipes for installation at Boulder power plant.	Consolidated Steel Corporation.	Los Angeles, Calif.	14,721.00		Aug. 13
46,970-A	Colorado River, Tex.	July 12	Thin wall steel tubing and fittings.	Smith Perry Electric Co.	Dallas, Tex.	[1] 13,658.40		Aug. 4
				Graybar Electric Co., Inc.	Denver, Colo.	[2] 95.82		Do.
931-D	Gila, Ariz.	June 17	Preparation of concrete aggregates.	George Pollock Co.	Sacramento, Calif.	[3] 147,780.00		Aug. 16
743	Shoshone-Heart Mountain.	Aug. 2	Earthwork, canal lining and structures, station 303 to station 712, Heart Mountain Canal.	James Crick	Spokane, Wash.	224,553.00		Aug. 21
952-D	All-American Canal, Ariz.-Calif.	Aug. 2	Metalwork for trash rack structure, All-American Canal headworks.	Independent Iron Works, Ltd.	Oakland, Calif.	[4] 15,313.00	Discount ½ percent	Do.
				Reliance Steel Products Co.	Rankin, Pa.	[5] 4,950.00	Discount 1 percent, f. o. b. Potholes.	Aug. 26
				Spuck Iron & Foundry Co.	St. Louis, Mo.	[6] 2,430.00	Net	Aug. 10
				California Steel Products Co.	San Francisco, Calif.	[7] 647.00	do	Aug. 25
947-D	Central Valley, Calif.	July 27	Materials for steel warehouse at Government camp at Shasta Dam.	Palm Iron & Bridge Works, Inc.	Sacramento, Calif.	2,948.48	do	Aug. 5
943-D	Boulder Canyon, Ariz.-Nev.	July 12	Six 200-kva, 2,400 to 277/480 Y-volt transformers for Boulder power plant.	Kuhlman Electric Co.	Bay City, Mich.	4,632.12	Net, f. o. b. Boulder City.	Aug. 23
953-D	Central Valley, Calif.	Aug. 12	4 motor-driven pumping units for Friant camp.	Food Machinery Corporation (Peerless Pump Division).	Fresno, Calif.	2,105.00	Net, f. o. b. Friant	Do.
954-D	Kendrick, Truckee Storage, Upper Snake River, Moon Lake, Uncompahgre, Carlsbad, Salt River.	Aug. 13	Needle-valve discharge guides.	John W. Beam	Denver, Colo.	5,025.00	Discount ½ percent	Aug. 26
				Berkeley Steel Construction Co.	Berkeley, Calif.	5,220.00	do	Aug. 27
956-D	All-American Canal, Ariz.-Calif.	Aug. 23	Structural steel and steel castings for railroad bridge over Pilot Knob wasteway.	Bethlehem Steel Co.	Chicago, Ill.	3,120.00	Net	Aug. 28
42,314-A	do	July 27	Steel reinforcement bars, 487,558 pounds.	Northwest Steel Rolling Mills, Inc	Seattle, Wash.	14,151.92	Discount ½ percent	Aug. 21

[1] Schedules 1 and 2. [2] Schedules 3 and 4. [3] Schedule 2, Schedule 1 not awarded. [4] Item 1. [5] Item 2. [6] Items 3 and 4. [7] Item 5.

Keeping Up with the Times

(Continued from p. 213)

Thesaurus or Webster's International, and you will admit the institution meets all demands.

ATTRACTIVE SURROUNDINGS

Until a few years ago the County Library, which is a Carnegie foundation, had not been landscaped and the women of the project brought plants, shrubs, and seeds to Miss Margaret Nye, under whose able direction the library was then and under whose regime the grounds grew from a weed patch to a beautiful lawn.

The Klamath City Library is nestled in the main part of the downtown district on a corner, surrounded by balm of gilead trees the branches of which reach their glistening leaves above the pavement's clatter and dust and lend a graciousness and wholesomeness to the location, while the County Library tops a rise that is circled by the Klamath Irrigation Canal, winding away at its base like a moat that guarded a castle of old. It looks out across lakes and fields and irrigation ditches that spell not only promise but realization of better homes and schools.

Milk River Indians

(Continued from p. 215)

ing from the Little Rockies to the Milk River. The lands in the foothills to the south were good bottom lands, but the north portion was bleak and arid. Buffalo became only a memory. Other prairie game rapidly disappeared, and until the year 1895, when the Indians began to practice farming, they were in a deplorable condition. The Gros Ventres now inhabit the foothills to the south and for many years have practiced irrigation under the tutorage of the kindly fathers of St. Paul's Mission. The Assiniboines, along the Milk River to the north, have the advantage of a Federal Indian irrigation system, which is the connecting link between the five irrigation districts of the Chinook division, and the Malta and Glasgow districts of the Milk River project. Tourists traveling west on Roosevelt Highway No. 2 enter the reservation just west of Dodson and leave it again after passing Harlem. Should they care to drive south to the Snake Creek battleground, they may still find relics of that battle of 1877.

If the human ear could still catch the battle echoes that reverberated through those bleak, badlands of wild Montana, what hideous war-whoops, what sickening screams of wounded ponies and nickering of terrified foals could be heard. Mingled with the barking and whining of dogs, the smacking thuds when bullets found flesh, would be the mournful death wail of women and the whimpering of frightened children. Above the curses and groans of pain-racked humans would sound the roar of musketry, the z-i-n-g pop pop of bullets and the whining flight of ricochets. Ever and anon, dying echoes would answer the shrill notes of the bugle. But the war whoop is stilled—the noises of Indian warfare are no more.

Progress of Investigations of Projects

Blue River transmountain diversion, Colorado.—Profiles were made of penstock sites for possible power plants in Bear Creek Canyon. Taking of strip topography along the canal line from Bear Creek to the outlet of the Continental Divide tunnel west of Empire, Colo., on the West Fork of Clear Creek, was continued. Topography for a dam site on the South Platte River just below the junctions of the North and South Forks was completed. Detailed plane-table surveys and geological maps were made of the Fall River and Trail Creek Dam sites located on Clear Creek about 2 miles above Idaho Springs, Colo., and of the Waterton and Two Forks Dam sites located on the South Platte River between South Platte and Waterton.

Eastern slope surveys, Colorado.—(*a*) *Cherry Creek irrigation and flood control.*—The report covering this feature of the investigations is in course of preparation.

(*b*) *Apishapa irrigation reconstruction.*—Surveys of this feature were completed early in the month.

Western Slope surveys, Colorado.—(*a*) *Collbran projects.*—The 48-mile level circuit for canal strip topography control was completed on the south side of the Plateau Valley. Strip topography of the "Peninsula" area was completed and then continued along the old Colorado canal to the "Sunnyside" area.

(*b*) *Florida project.*—A topographic survey of reservoir sites on Florida River on the Henry Lemon property, and a preliminary location of a canal from Pine River to Florida Mesa were completed.

(*c*) *Fruit growers reservoir.*—Detailed topographic surveys, together with test pits and percolation tests thereof, were completed during the month in the vicinity of the dam destroyed during May of this year.

(*d*) *La Plata project.*—Reconnaissance for the feeder from East Mancos River to Thompson Park on Cherry Creek, indicates that about 1½ miles of easy canal construction will deliver the flood flow of the river in the La Plata drainage for use in New Mexico and the lower part of the Colorado land. A reconnaissance of the upper La Plata River above Hesperus indicates that a small reservoir site may be available at Parrott City.

(*e*) *Lilylands project.*—A preliminary examination was made of this project which is in the basin of the San Miguel River, in Dolores and Montezuma Counties.

(*f*) *Paonia project.*—Levels were run to and topography taken of a reservoir site on the Smith Fork of the Gunnison River. Detail topography of the dam site was begun, and test pits laid out.

(*g*) *Silt project.*—Reconnaissance surveys were made on Meadow, Corral, and Main Elk Creeks for alternate features to supplement the Harvey Gap Reservoir.

(*h*) *Troublesome project.*—Strip topography was completed south of the Main Troublesome River from the mouth of the deep canyon to the town of Kremmling. A reconnaissance survey was made of the area on the Upper Muddy Creek. Strip topography was started on the proposed canal from the East Troublesome Creek to the Kurtz lateral heading on the Main Troublesome.

Rio Grande joint investigations, Colorado-New Mexico.—All field work was completed by July 10. Studies were made of possible power production at seven storage and power sites on Willow Creek and the Chama River. The amount of replacement storage that will be required on the lower San Juan to permit full diversion by the San Juan-Chama diversion was estimated. Revision of the preliminary report was in progress.

Boise (Boise-Weiser-Payette), Idaho.—An inspection was made to determine the irrigability of the lands in T. 6 N., R. 4 W., B. M. A reconnaissance survey was made to determine the irrigation possibilities in T. 5 N., R. 1 and 2 W., B. M., with a 100-foot pump lift from the Farmers Union Canal. An investigation was made of the possibility of pumping water from Snake River near the southwest corner of T. 1 N., R. 2 W., B. M., onto high lands in that vicinity and into the Mora Canal of the Boise project. A survey is in progress to determine the possibility of diverting, by tunnel, the flow of Salmon River, in the vicinity of Stanley Basin, to Baron Creek. Field work on the Twin Springs Dam site topography was completed. Detailed topography of the dam site at Cascade was secured and several miles of center line for the railroad relocation were run. Levels for vertical control of a survey of the Cascade Reservoir site were run, a base line measured, triangulation stations established, and all triangulation angles turned. An investigation was made to determine the approximate irrigated acreage, lands susceptible of irrigation, and possibilities of storage on Willow Creek, Little Willow Creek, and Squaw Creek.

Buffalo Rapids investigations, Montana.—Additional investigations were started on July 16, to determine the best layout for the Glendive unit of the project, which is proposed as the first unit of construction. The present investigation concerns a plan with two canals at different levels and with alternate pumping plant locations.

Gallatin Valley investigations, Montana.—Work was in progress on the draft of the report on the investigations.

Conchas surveys, New Mexico.—A review of the draft of the report was in progress.

Altus project surveys, Oklahoma.—The work of classifying the lands of the project has been completed. Surveys were continued on the Elm Fork diversion with alternate locations, and surveys of the main canal location are being made on each side of the river below the dam. Diamond drilling of the dam site is being continued, five holes having been completed to date.

Canby project investigations, Oregon.—Work was continued on this investigation. Water-supply records and crop-census data are being secured. A considerable amount of basic data is being assembled, and a rough draft of a report on the project has been partially completed.

Deschutes investigations, Oregon.—A stadia traverse and levels were run and side slopes at angle points were recorded.

Grande Ronde investigations, Oregon.—A second reading of the water level in the ground-water wells of the Grande Ronde Valley was made during the month The running of levels for permanent bench marks in the valley was completed on July 7. Temporary bench levels are being established for planetable use only. The survey covering the lower Grande Ronde Dam site was completed during the month. A planetable reconnaissance survey of possible highway locations was made around the lower reservoir site. Approximately 44 miles of stadia line, were run during the month. The survey of the Catherine Creek Reservoir site and the detailed dam-site survey were completed. A horizontal and vertical control line has been run up the two branches of the valley from the Sheep Ranch dam site established in a previous survey.

Rapid City project, South Dakota.—The field work has been completed, with the exception of stream gaging, which is being carried on by local interests.

Colorado River Basin investigations.—(*a*) *Disappointment Creek, Colorado.*—The classification of undeveloped lands in the Disappointment Creek basin was taken up during the month and an area of 23,360 acres was completed.

(*b*) *Irrigated area survey, Monticello, Utah.*—Mapping of irrigated lands in the vicinity of La Sal, Utah, and along Montezuma Creek was completed on July 9.

(*c*) *Piceance Creek, Colorado.*—Mapping of the irrigated lands along Piceance Creek and its tributaries was completed during the month.

(*d*) *Price and San Rafael Rivers, Utah.*—Mapping of irrigated lands along the Price and San Rafael River drainages, in the vicinity of Price, Castle Dale, and Ferron, Utah, was continued. Classification of undeveloped lands adjacent to the present irrigated areas was begun.

(e) *San Miguel area, Norwood, Colo.*—Classification of undeveloped lands on the proposed Lilylands project, near Norwood, Colo., was completed. Mapping of irrigated lands on the San Miguel project and along the upper San Miguel River was continued. Horizontal control for the land classification, including flagging of land corners, was completed.

(f) *Thompson-Cisco area, Utah and Colorado.* Classification of 13,920 acres of arable lands occupying benches above the 4975 contour in the vicinity of the tunnel site on the Thompson-Cisco project was completed, which completed the land classification in this area.

(g) *White, Escalante, and Paria Rivers, Colorado and Utah.*—A rough reconnaissance was made of the White, Escalante, and Paria Rivers to outline future work and determine the amount of area yet to be covered on these tributaries of the Colorado River.

Large Irrigation Dam in Mexico

A large storage dam near El Palmito, State of Durango, is being built by the Irrigation Commission of Mexico for the storage of water of the Nazas River for irrigation purposes. The location is a gorge 2 miles below the confluence of the Ramos and El Oro Rivers.

Preliminary surveys were made in 1936 by the National Irrigation Commission. Preparatory to the construction of the dam, it was necessary to construct a road 103 miles long from Bermejillo, the nearest shipping point by rail, which was completed by the end of 1936.

Construction of the dam was begun in February, 1937, by Government forces, and it is expected that 1,700 persons will be employed. Present plans contemplate completion of the dam in 1940.

The dam will be an earth and rock fill structure 328 feet in height, with a volume of 7,200,000 cubic yards. The plan is reported to be somewhat similar to the San Gabriel Dam in California now under construction. There will be three outlet and diversion tunnels 23 feet in diameter and about 2,000 feet in length each. The storage capacity of the reservoir will be 3,500,000 acre feet.

The cost of the dam, including roads and other preliminary work, is estimated to be over $9,000,000. The cost of equipment, a large part of which will probably be purchased in the United States, will be about $1,600,000. This will include power shovels, Diesel electric plant, air compressors, pumps, steel forms for tunnels, tractors, trucks, and road-grading equipment.

It is understood that the construction of a hydroelectric plant is under consideration.

Wyoming Project Renamed in Honor of Senator Kendrick

The project under construction by the Bureau of Reclamation in Wyoming, formerly known as the Casper-Alcova project, was renamed with the enactment of the Interior Department appropriation bill for 1938 as the Kendrick project, in commemoration of the life and work of the late Senator John B. Kendrick, of Wyoming.

Senator Kendrick, born September 6, 1857, in Jacksonville, Tex., moved to Wyoming in 1879, settling on a ranch near Sheridan. He engaged in cattle and sheep raising in Wyoming and Montana for many years. In 1910 he was elected to the Wyoming State Senate and served 4 years. He was Governor of Wyoming from 1915 to 1917, when he resigned to take the seat in the United States Senate on March 4, 1917, to which he had been elected in November 1916. He served continuously in the Senate until his death November 3, 1933.

From the time that the water conservation and irrigation project now named for him was first proposed, 30 years ago, Senator Kendrick was its staunch proponent. He carried on an active compaign to have it approved from 1920 until 1933. The project was approved for construction and a Public Works allotment made, but Senator Kendrick died before construction began. The policy of the Department of the Interior has been to discourage the naming of improvements in honor of living men.

The Kendrick project will be one of the principal irrigation projects in the central part of the State of Wyoming. It consists of Seminoe Dam, a major storage dam on the North Platte River about 60 miles southeast of Casper, of the Alcova diversion dam, and the Casper Canal, which extends from the diversion dam to near Casper, Wyo., where 35,000 acres of land will be irrigated. All the major features of the project are now under construction and the project as a whole is about 35-percent complete.

A spontaneous movement in the State of Wyoming to honor the late Senator resulted in the inclusion in the departmental appropriation act of a provision which renamed the project the Kendrick project.

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Excavation for Parker Dam reaches the final stage, illus., The Earth Mover, July 1937, vol. 24, pp. 22–23.

Livestock Feeding in the Valley Division, Yuma Project

By Henry Frauenfelder, President, Yuma County Water Users Association

WINTER fattening of sheep and cattle in the Valley Division of the Yuma project has been developed into an important part of the agricultural program now being carried out in this section. The practice was first begun in a small way during 1918, when approximately 500 head of beef cattle were brought in from the range to be fed and fattened. During the following 10 or 12 years only a slight increase was registered annually in the number of cattle fed, although during this period the first sheep in considerable numbers were shipped here for winter pasture. It has been demonstrated that our mild winter climate and continuous growing season for alfalfa offered ideal conditions for ewes during the lambing season.

During 1931 substantial increases were noted in the numbers of livestock and sheep that were shipped in to be fed. About 6,000 head of cattle and a like number of sheep were fattened during that year, most of which then went to the nearby Los Angeles livestock market. By 1934 the number on feed reached approximately 11,000 head of beef cattle with a corresponding increase of sheep.

A survey made in the spring of 1937 indicates that 30,000 sheep, ewes, and lambs are being fed here, among which are many fat lambs ready for market. The early lambs were born on the ranges and weaned before being put on our winter pasture. Large numbers of old ewes will also be prepared for market while those with late lambs born here will be taken back to the ranges in the higher altitudes of northern Arizona and New Mexico for summer feeding.

Beef cattle feeding is being undertaken by more farmers each year. Some prefer to do all the feeding and fattening in corrals and pens while others pasture their animals during the earlier part of the fattening period. During the past several years the spread in price between range cattle and fattened cattle has been proportionately less than formerly and consequently no large profits have been made by feeders in recent years. However, there are benefits to be derived from feeding cattle, other than the immediate cash profits. For instance, such a program provides a source of valuable organic fertilizer and offers an opportunity to utilize poorer grades of hay which, owing to a little excess bleaching or the presence of a few weeds, would be classed as low grade, but which nevertheless has a high feeding value. Alfalfa straw, when combined with concentrates, can be used to perhaps the greatest advantage by feeding to livestock.

During the winter of 1936–37 there were approximately 8,000 head of cattle in the Valley Division for winter feeding and fattening. Shipments of livestock from Yuma for the calendar year 1936 totaled 423 carloads, of which 248 cars were forwarded by rail and the balance of 175 by truck; the estimated value of these shipments was $423,500. Although livestock shipments constituted approximately 5 percent of the total cars of farm commodities forwarded from Yuma during the year, they composed 11 percent of the estimated value of all shipments of farm products, being exceeded only by lettuce, cotton, and grapefruit in point of value.

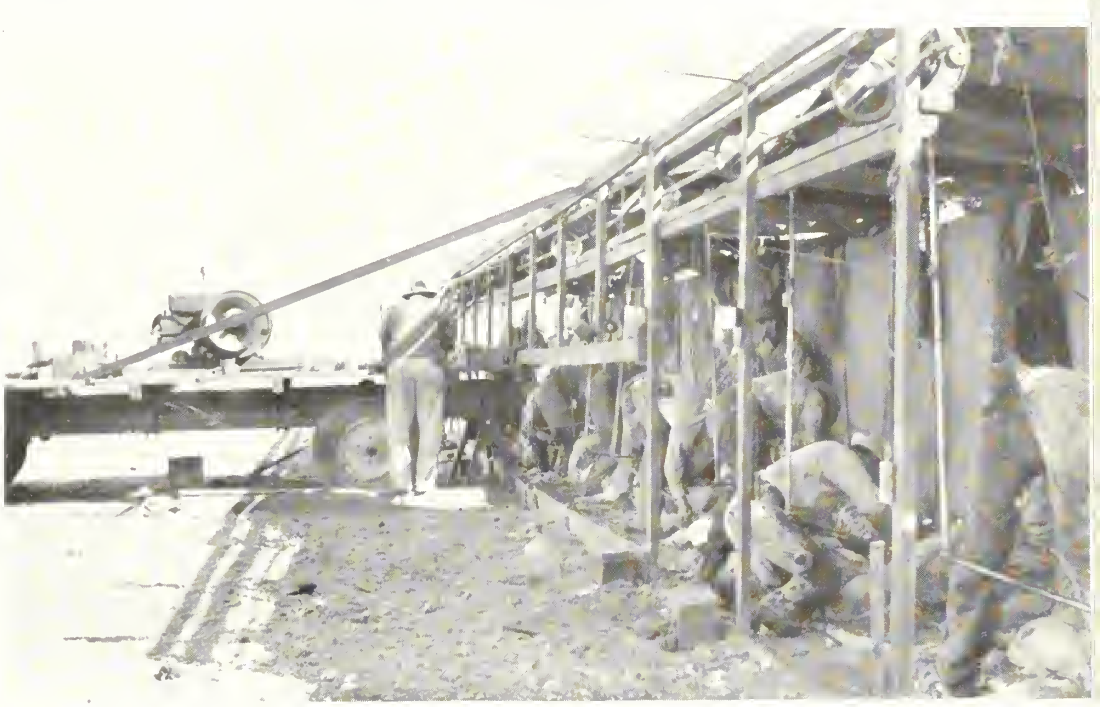
An up-to-date and very complete feeding plant consisting of a mill, feed lots, warehouses, trench silo, scales, etc., was built last year by a Los Angeles corporation interested in Yuma Valley farm lands, open ranges in other sections, and an industrial packing plant in Phoenix. This plant has a capacity for fattening 5,000 to 10,000 head a year. It is planned to enlarge this plant in the near future. A second large facility for feeding is being constructed at the present time by an experienced cattleman from California who recently acquired irrigated farm lands in the Valley Division.

Pasturing of sheep and cattle enables the farmer to secure some financial returns for winter growth of barley and alfalfa which in many instances would not make a good grade of hay if cut and cured in the usual way. Sheep especially will graze much closer than a mower blade cuts, and they will clean up fence corners and other places usually overlooked or neglected. They are also invaluable for cleaning up weeds on ditch banks and are most helpful in discouraging the operations of gophers.

NOXIOUS WEEDS DRAWBACK TO GRAZING

A serious drawback to grazing both sheep and cattle lies in the consequent spread of noxious weeds. Seeds of all descriptions cling to the animals while feeding on weed-infested ranges elsewhere, to drop off later on some otherwise clean farm. This is a hazard that should be recognized, although if the proper attention is paid to all weeds as they appear the danger of new weed infestation is minimized.

In addition to favorable climatic conditions and abundant feed stuffs to be found here, the close proximity of the Los Angeles market to the Yuma Valley is an important advantage. Cattle and sheep are shipped there by truck over modern highways. If transportation by rail is preferred, the shipper is assured that delivery of his consignment to market will be made within a day's time.



SHEARING SHEEP ON VALLEY DIVISION FARM OF HENRY FRAUENFELDER, PRESIDENT, YUMA COUNTY WATER USERS' ASSOCIATION

Local banks as well as Federal credit agencies recognize the value of cattle-feeding operations as part of a balanced agricultural program, extending liberal credit to farmers for this purpose. It is hoped by those interested in the welfare of the Yuma project that still further expansion will take place in the local cattle-feeding industry.

Accomplishments of Bureau CCC Camps

By Clyde C. Beam, Assistant to Supervising Engineer, CCC

THE first CCC camp to operate under the supervision of the Bureau of Reclamation was established on the North Platte project, in Nebraska and Wyoming on May 21, 1934.

From that date to August 1935, an average of 10 CCC camps were in operation, which number was increased during August, September, October, and November 1935 to the present total of 34 active camps. The following is a list of reclamation projects and the number of camps now in operation under the supervision of the Bureau of Reclamation:

Project	State	Number of camps
Belle Fourche	South Dakota	1
Boise	Idaho	2
Carlsbad	New Mexico	1
Grand Valley	Colorado	2
Humboldt	Nevada	1
Huntley	Montana	1
Klamath	California	1
Klamath	Oregon	1
Lower Yellowstone	Montana	1
Milk River	Montana	1
Minidoka	Idaho	1
Moon Lake	Utah	1
Newlands	Nevada	3
North Platte	Nebraska	3
Ogden River	Utah	1
Owyhee	Oregon	2
Rio Grande	New Mexico	3
Rio Grande	Texas	1
Salt River	Arizona	1
Shoshone	Wyoming	1
Sun River	Montana	1
Umatilla	Oregon	1
Uncompahgre	Colorado	1
Vale	Oregon	1
Yakima	Washington	1
Total		34

Two main classes of work have occupied a majority of the time of the enrollees. First and most important is the rehabilitation and improvement of the storage, distribution, and drainage systems on the reclamation projects; and second, the development of recreational facilities for the general benefit of the inhabitants of our reclamation projects and surrounding areas.

REHABILITATION

The recent years of depression necessitated a retrenchment program in respect to expenditures, consequently the upkeep and improvement of the irrigation and drainage systems on most of the projects become difficult and much of it had to be deferred.

Fortunately for the projects which were facing the costly job of rehabilitation brought about by this accumulation of delayed work, CCC camps were apportioned to the various reclamation projects in the West to assist in this work and in necessary betterments in the interest of water conservation.

STORAGE IMPROVEMENTS

The depression era was also one of acute water shortage on some projects. This indicated that a few of the storage facilities, though ample under ordinary conditions, were inadequate in times of drought.

To remedy this situation CCC forces are being used to advantage in building the Midview Dam and dike, which will create a 5-000-acre-foot reservoir on the Moon Lake project, Utah; in building the Duchesne feeder canal on the same project, which will divert water from the Duchesne River to the reservoir and to Indian project lands on the Lake Fork River in exchange for Lake Fork waters which will be utilized on the higher lands of the Moon Lake project; in the construction of the Anita Dam of the Huntley project, Montana, which will equalize the flow of the High Line Canal and provide a small storage capacity; in repairing earth dams, as at Deer Flat Reservoir on the Boise project, Idaho; and in the construction and improvement of storage facilities for other projects.

Work on storage improvements resulted in the following accomplishments: CCC forces placed 1,714 cubic yards of concrete, 446,000 cubic yards of earth fill, 88,700 cubic yards of rock fill, 35,800 square yards of rock riprap, 6,880 cubic yards of rock masonry and 45,000 pounds of reinforcing steel in various dams. Excavations for corewalls, outlet works, spillways, and stripping of foundations amounted to 216,600 cubic yards of earth and 4,800 cubic yards of rock. Reservoir areas aggregating in excess of 3,700 acres were cleared of trees and brush to insure trouble-free operation of control gates, power plants, and appurtenant dam structures.

ACCOMPLISHMENTS ON DISTRIBUTION SYSTEMS

Work on distribution systems consisted of returning weed- and silt-filled canals and laterals to a proper cross section; the replacement of decaying wood structures with concrete; reconditioning of operating roads; sealing of porous canals by earth or concrete lining; and on some projects all work incidental to new lateral construction. On the Vale project, in eastern Oregon, CCC forces are nearing the completion of the Willow Creek lateral system, which entails the construction of 80 miles of lateral and more than 600 concrete structures and will provide water for many acres of new land, much of which has already been settled.

The acute drought of recent years has forcefully indicated a need for more economic distribution of available water, and to that end the CCC forces have placed 297,500 square yards of concrete lining and 245,500 square yards of earth lining in canals and laterals. This work will have the twofold purpose of con-

CCC ENROLLEES LINING A CANAL ON THE KLAMATH PROJECT, OREGON-CALIFORNIA.

serving water and protecting the lands below these heretofore porous sections of canal from harmful seepage.

Work on rehabilitation and construction of canal and lateral systems produced the following results: Removal of silt, weeds, brush, etc., from more than 42,806,000 square yards of canal; the excavation of 1,809,000 cubic yards of earth and 53,000 cubic yards of rock; the installation or reconditioning of 140.000 linear feet of pipe; the placing of 349,000 square yards of rock riprap and 116,000 square yards of willow or brush riprap; the placement of 22,544 cubic yards of concrete and 659,000 board feet of timber in more than 5,100 structures, and the placing of 3,226 cubic yards of concrete in the construction of concrete core walls in canal banks and small earth dams. In addition, more than 200 bridges were built over canals and laterals on reclamation projects.

RECREATIONAL DEVELOPMENTS

Several of the projects have areas adjacent to rivers, reservoirs, or lakes, which are ideally located to be used as parks, camp grounds, or picnic grounds. Some of these areas have been developed by the CCC through construction of tables, benches, stoves, fireplaces, water systems, latrines, sewage disposal plants, and other improvements and now provide excellent places for recreation for the residents of the communities. The area adjacent to Elephant Butte Dam, on the Rio Grande project, New Mexico, at Guernsey Lake on the North Platte project, Nebraska-Wyoming, and the park on the shores of Lake Walcott on the Minidoka project, Idaho, and others are good examples of this type of work.

FLOOD CONTROL

A third class of work, which provides a wide field of endeavor but has not as yet been entered into to the fullest extent by the CCC because of more urgent work, is flood control. Nearly all parts of the West, especially those areas occupied by reclamation projects, have very light yearly rainfall but are subject to intense centralized rains of short duration which cause untold damage to irrigation systems. To date, 98 flood control dams have been built by the CCC varying in size from quite small to larger ones, such as the Apache Dam described in the July 1937 Reclamation Era.

WEED, PEST, AND RODENT CONTROL

Another enterprise which is of great benefit is the war being waged by the CCC on three foes of irrigation farming, namely, weeds, rodents, and insect pests.

Weed eradication by the Bureau of Reclamation CCC forces has been confined to canal, lateral, and stream banks except on a few demonstrational plots in private fields to illustrate approved methods and interest project farmers in weed control. The removal of weeds from 14,000 acres of this public land has greatly enhanced the effectiveness of community weed control programs, as these heretofore neglected areas have been favorite propagating places for weeds with the adjacent streams always available to scatter the seeds to all parts of the irrigation project.

The program of rodent control has been given close attention by the CCC in the poisoning and trapping of thousands of gophers, ground squirrels, and other devastating rodents over more than 1,112,460 acres on the reclamation project. The Biological Survey with its background of many years of experience has extended full cooperation in this rodent-control work thereby insuring the safe handling of all poisons used. Insect pest control, requiring less attention and effort, resulted in the treatment of 5,800 acres of ground.

The CCC camps, operating under the supervision of the Bureau of Reclamation, have been singularly fortunate in having the full cooperation of the regular forces of the Bureau of Reclamation. These men, with years of engineering experience and familiarity with irrigation problems, have been liberal with their advice and counsel and have willingly given much time to the more difficult construction problems encountered by the CCC. The plans and sites of all major structures were duly investigated and approved by Bureau officials before the start of construction, to insure their desirability and durability. With the Bureau of Reclamation standards of construction as a criterion, the CCC enrollees have taken great pride in their ability to build useful and lasting structures.

The many achievements of the Bureau of Reclamation CCC camps, resulting from an expenditure exceeding 2,163,500 man-days of work, stand as worthy examples of the type, quality, and usefulness of the work being done throughout the reclamation projects.

CONSTRUCTION is under way on the first unit of the fruit and vegetable cannery of the Yakima Growers Cooperative, Inc. The unit will be 69 by 128 feet in size, of hollow concrete construction, and is estimated to cost $20,000. The plant is to be completed in time to handle this season's pears and peaches.

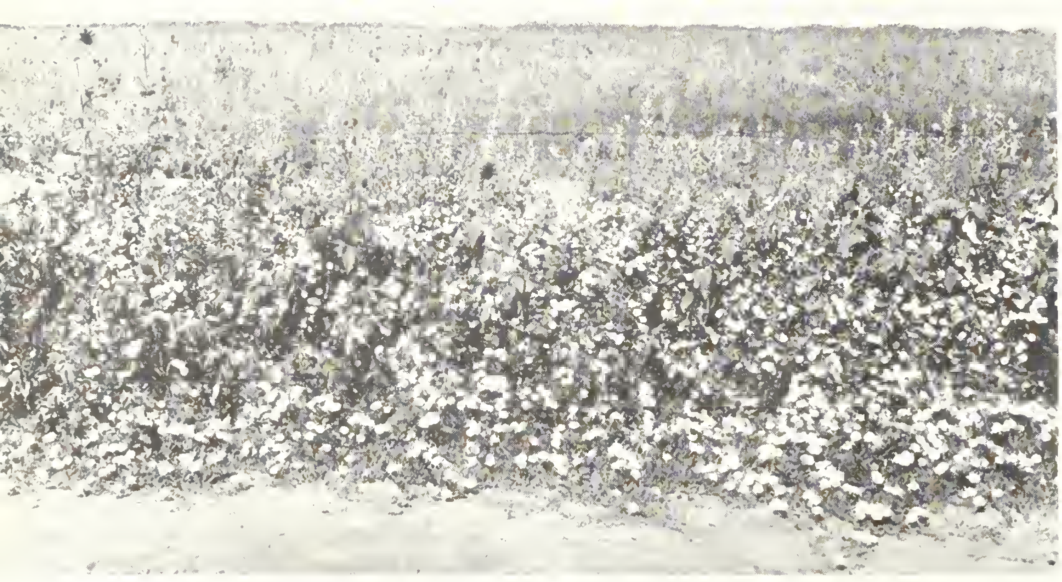
CCC FORCES REMOVING SILT FROM A HALF-FILLED CANAL ON THE SHOSHONE PROJECT, WYOMING.

Field Bindweed a Serious Weed Pest

J. W. Zahnley and W. F. Pickett, Kansas State College of Agriculture and Applied Science

FIELD bindweed is by far the most dangerous and destructive weed found in Kansas. It is causing alarm not only in this State but over a large part of the United States, particularly in the West. It now occurs in every county in Kansas and is spreading at an alarming rate. Some farms are so completely overrun with the weed that crops can be produced only by the expenditure of much additional labor, without which greatly reduced yields are obtained. Such farms are regarded by many as nearly worthless in their present condition and would not sell for one-half the normal price if put on the market. Some loan companies refuse to accept mortgages on farms known to be infested with this weed.

Crop production on heavily infested land is rarely profitable. The bindweed roots explore the soil as deep as the roots of most crops and remove both plant nutrients and moisture. The twining vines of the weed bind the crop plants together, completely override the crop, reduce yield, and make harvesting difficult.



FIELD BINDWEED, ALSO KNOWN AS WILD MORNING GLORY AND CREEPING JENNY.

HOW TO IDENTIFY BINDWEED

Field bindweed is a long-lived perennial belonging to the morning glory family and is frequently referred to as "wild morning glory." It can be distinguished by its small bell-shaped flowers which are scarcely half as large as those of the common morning glory or of the hedge bindweed and which range in color from pure white or slightly tinged with pink to almost pure pink. The leaves vary in size and shape, but are usually small, somewhat arrow-shaped, and blunt or rounded at the tip. The plant produces a trailing or twining growth of vines which climb up any support, such as other weeds and stems of crop plants. The seed is about one-eighth of an inch long, dark grayish-brown color, and covered with raised dots or pimples which can be easily seen with the aid of a small magnifying glass. In shape, the seed somewhat resembles a quarter of a sphere, although this varies with the number of seeds in the pod. The size and shape of the seed are such that they are difficult to separate from wheat, oats, barley, sorghum, or Sudan grass seed.

The root system of bindweed is very extensive. It penetrates the soil to a depth of 4 feet or more, and roots have been found to reach depths of 15 to 25 feet. The main roots are long, tortous, whitish cords about one-tenth of an inch in diameter, with many branches. These roots scracely diminish in size at a depth of 4 or 5 feet. In excavations where 6 feet or more of surface soil was removed a stand of bindweed was soon produced at the bottom of the excavation from the roots extending below that depth, showing that the fleshy roots may form buds and give rise to new plants anywhere along their length.

The seed of bindweed has great vitality and if plowed under will remain buried in the soil from one season to another without injury and will germinate when brought near the surface. The seed germinates any time from early spring until fall, when conditions become suitable. The seedlings thus produced make little top growth the first season, but the roots grow rapidly and soon reach a depth of 2 feet or more. It has been found that in 6 weeks after seed sprout the seedlings become so thoroughly established that they will not be killed by cutting them off 2 or 3 inches below the surface of the ground.

HOW BINDWEED SPREADS

Bindweed is spread both by seed and roots. New patches in uninfested fields or localities are started from seed which in most instances is carried in impure crop seed or by threshing outfits. Thirty-one samples of crop seed tested in the Kansas Seed Laboratory in the spring of 1934 contained an average of 57 bindweed seeds to the pound. These 31 samples included 20 of oats, 7 of Sudan grass, 2 of sweet clover, 1 of barley, and 1 of sorgo. Planting this oats at the rate of 70 pounds to the acre would distribute approximately 25 bindweed seeds to the square rod. This would be more than sufficient to produce a full stand of bindweed.

The seed may be scattered locally by feed grown on infested land, in the manure of animals grazed on infested land or consuming feed containing bindweed seed. Commercial feed, chicken feed, and screenings bought on the market frequently contain bindweed seed. The seed is carried on the feet of animals, on wheels of vehicles, or by road-maintaining machinery. Drainage water is an important means of spreading bindweed, carrying the seed down slopes or ravines during torrential rains.

When a plant becomes established, horizontal roots are produced which have been found to grow in plowed land to a distance of 7 feet in a period of 90 days. At distances of every foot or two new plants arise from these lateral roots. By this means, as well as by seed, the patches become larger and the stand of plants thicker from year to year. It can readily be seen that from a start of a few widely scattered plants an entire field or farm may become solidly infested within a few years.

CONTROL OF BINDWEED

Prevention is the most important consideration where the land is free from the weed. Every possible precaution should be used to avoid bringing bindweed on the farm. It is easier to prevent the weed's getting a start than to eradicate it after it is started. All crop seed should be tested for purity before planting. Any seed purchased should bear the label of tested seed as prescribed by the seed

law, and the purchaser should insist upon a guarantee that the seed is free from bindweed seed. Care should also be taken to avoid bringing feed grain, roughage, or manure to the farm from areas that are infested and to prevent the introduction of the weed by any other means by which it may be spread. Eternal vigilance is the price of success in keeping the farm free from bindweed.

A second important consideration is keeping constantly on the lookout to detect the first plants that appear. Isolated plants or small patches are readily seen when in bloom. The main bloom period is usually from about May 15 to June 15, but flowers may appear over a much longer period. The flowers are most abundant and conspicuous in the forenoon of a bright day following showers; hence patches are most easily found under these conditions. Plants usually do not bloom before they are about 2 years old, so it is often necessary to detect new patches by the appearance of their vegetative growth. The small patches should be killed first to reduce the number of sources of infestation.

As soon as a plant or patch is found, its location should be conspicuously marked by a stake or label and the infested area isolated. This area should not be cultivated with the remainder of the field on account of the danger of spreading the weed. Small patches can be killed with relatively little trouble and expense and should be given immediate attention. The sodium chlorate spray method and application of common salt are the most widely used and practical means of killing the weed when the infested area is small.

Attempts to eradicate large areas should ordinarily be delayed until the small patches are killed. A well-planned system of cultivation and cropping should be used that will reduce the danger of spreading the weed. Eradication by intensive cultivation combined with the growth of smother crops should ordinarily be started as soon as possible.

ERADICATION OF FIELD BINDWEED REQUIRES PROMPT, STRENUOUS, AND DETERMINED EFFORT

Bindweed should be killed when first discovered. Delay makes control more difficult and expensive. If this menace is permitted to grow undisturbed, it soon takes possession of the land, making it almost worthless for crop production.

In the killing of bindweed by any method, the work should be confined to an area of such size as can be thoroughly handled. Undertaking too much means a waste of effort. A small area properly handled each year will lead to better results than a larger area neglected.

In a campaign against bindweed the work demands first attention and should take precedence over other farm operations. Carelessness will result in a loss of labor and material. There is no halfway point in the destruction of bindweed.

Returns from Irrigated Crops are High

In 1936 crops harvested from the Federal reclamation projects averaged in value $48.40 per acre, while the general average for all crops throughout the Nation was $19.18 per acre.

Crops of the Federal projects brought to the farmers 2.52 times the returns received on the average by farmers with equal acreage in the humid sections.

The results obtained in 1936 were not extraordinary, for the records disclose that approximately the same ratio between the value of crops per acre on the Federal projects and the value of crops per acre generally throughout the country has remained nearly the same for many years.

Several factors apparently contribute to the higher return per acre received by the irrigation farmers. Irrigation provides a control over the application of water to the land which enables the farmers to obtain greater yields and to grow more diversified and profitable crops. It encourages intensive cultivation as well. That this is so, of course, is an advantage which helps offset for the West the handicaps of the region, which is semiarid and arid.

Irrigation entails greater expense both in operation of the farm and in rendering the land originally productive, as elaborate and costly water systems are involved.

The high production of irrigated land in part mitigates the serious disadvantage at which the West is placed, only about 4 percent of the lands in this region being arable because of deficient rainfall.

The accompanying table gives a comparison of the crop production on Federal reclamation projects and that of the entire United States.

Comparison of crop production on Federal reclamation projects with production of entire United States

	Entire United States			Federal reclamation projects			
	Gross value of crops	Cropped acreage	Value per acre	Gross value of crops	Cropped acreage	Value per acre	Ratio
1929	$8,088,494,000	357,827,000	$22.62	$88,459,390	1,512,250	$58.50	2.58
1930	5,818,849,000	359,927,000	16.15	65,007,270	1,550,967	41.90	2.59
1931	4,122,850,000	350,672,000	11.75	40,554,037	1,520,354	26.70	2.27
1932	2,878,986,000	359,422,900	8.02	31,531,162	1,578,880	20.00	2.50
1933	4,076,537,000	327,324,230	12.45	48,765,863	1,598,702	30.50	2.45
1934	4,779,335,000	286,512,000	16.68	59,628,327	1,464,405	40.75	2.44
1935	[1] 5,418,755,000	[2] 336,170,900	16.11	63,601,663	1,604,166	39.65	2.44
1936	6,084,932,000	[2] 315,068,000	19.18	78,902,818	1,629,174	48.40	2.52

[1] Total farm value of 64 crops.
[2] Total acreage of 44 crops (excluding duplications).

Promotion of Western Interests Desired by President Jefferson

In the reference library of the Bureau of Reclamation in Washington is a bound copy of the State papers and correspondence bearing upon the purchase of the Territory of Louisiana by the United States, including the treaty of purchase, the correspondence bearing dates from March 29, 1801, to November 7, 1831.

From a letter written by President Jefferson to Dr. Priestley on January 29, 1804, the following significant extract showing President Jefferson's attitude toward the development of our western country is quoted:

"The denouement (Louisiana purchase) has been happy; and I confess I look to this duplication of area for the extending a government so free and economical as ours, as a great achievement to the mass of happiness which is to ensue. Whether we remain in one confederacy, or form into Atlantic and Mississippi confederacies, I believe not very important to the happiness of either part. Those of the western confederacy will be as much our children and descendants as those of the eastern, and I feel myself as much identified with that country, in future time, as with this; and did I now foresee a separation at some future day, yet I should feel the duty and the desire to promote the western interests as zealously as the eastern, doing all the good for both portions of our future family which should fall within my power."

Buffalo Rapids Receives Allotment

One million six hundred and five thousand dollars of Emergency Relief funds have been made available for the construction of pumping plant, canal, laterals, and structures of the Glendive unit, Buffalo Rapids project, Montana, for the irrigation of land in the Yellowstone River Valley. Of this amount $776,000 is made available on a reimbursable basis, the balance for work relief.

Pine View Dam Dedicated

August 14, 1937, witnessed the dedication of Pine View Dam on the Ogden River project, and its two connecting canal systems which will carry water to nearly 22,000 acres of rich farm and orchard land in Weber and Box Elder Counties, Utah. Construction of this project was approved by President Roosevelt and work on the dam was started in October 1934. The estimated cost of the dam is $1,382,900.

Ora A. Bundy, president of the Ogden River Water Users' Association, acted as master of ceremonies on the occasion of the dedication. The dedicatory address marking the official transfer of the dam and its two canal systems from the Reclamation Bureau to the Water Users' Association was delivered by Gov. Harry H. Blood of Utah. R. F. Walter, of Denver, chief engineer of the Bureau of Reclamation, gave an address on "How the Pine View Dam would have been built 30 years ago", and J. R. Iakisch, construction engineer of the Ogden River project, spoke on the many engineering features involved in the construction of the dam.

Secretary of the Interior Ickes and Commissioner of Reclamation Page were unable to attend the ceremonies because of other pressing duties in Washington. Mr. Page expressed his regrets by letter, which also conveyed his congratulations as follows:

"I wish at this time to extend my congratulations to the Ogden River Water Users' Association upon completion of the Pine View Dam and sincerely trust that the members of the association will realize in full measure the benefits of this storage and that it will be an important factor in increasing the prosperity of the community."

The Ogden River project was turned over to the water users for operation on August 1, 1937.

The story of the construction of Pine View Dam as told by G. C. Imrie, associate engineer of the Ogden River project, is carried in the August issue of the Reclamation Era.

Tungsten Mining, Humboldt Project

The Nevada-Massachusetts Co. maintains its main office in Lovelock, Nev., the principal town on the Humboldt project. This company operates a tungsten mine located about 55 miles northeasterly from Lovelock and produces more than one-half of all the tungsten produced in the United States. The ore deposit is of the contact-metamorphic type, the veins being a replacement of thinly bedded limestone, tipped to a high angle and altered by granitic intrusions.

The tungsten mineral is scheelite (the tungstate of lime) containing when pure, 80.3 percent tungstic trioxide. The average grade of the ore is about 1 percent scheelite. While the crude ore contains 11 different metals, it is so refined in the milling process that not more than a trace of any metal other than tungsten remains in the finished product. It is packed for shipment to manufacturers of ferro in Pennsylvania in double sacks of canvas and burlap. There it is melted under the electric arc with 20 percent of pure iron into ferro-tungsten, in which form it is sold to the steel manufacturers.

Its uses are many. A small amount is made into metallic tungsten for contact points on automobiles and other electric devices and for incandescent lamp filament wire. Another small portion is used to flame-proof fabrics and theater drops and curtains; for the tanning of white leather; the weighting of silks; for brilliant and permanent pigment colors; for inks and dyes; and as a mordant for "setting" fadeless dyes.

The distinguishing characteristic of the element, tungsten, is its property of "red hardness"; that is, its ability to retain its hardness at a red heat. This is particularly valuable as an alloy with steel in the manufacture of valves and valve seats for internal combustion engines, for hot saws, piercing points, dies, punches, and shears in steel mills, for lathe cutting tools, and other high-speed tools. Cemented tungsten carbide for use in high-speed tools has a hardness of 9.8 in the scale of hardness, in which the diamond is rated as 10. The specific gravity of ductile tungsten is 21.3, being appreciably heavier than gold with a specific gravity of 19.3, and almost exactly twice as heavy as lead. Ductile tungsten is capable of being cold drawn through a diamond die into wire having a diameter which is approximately one-sixth of the diameter of the adult human hair. In this size it has the strength of piano steel wire.

Public Relations Service

UNMOUNTED PHOTOGRAPHS

Unmounted exhibits on the subject of Federal reclamation are available upon application to the Bureau of Reclamation, Department of the Interior, Washington, D. C., on the following subjects:

- Boulder Dam, Nev.-Ariz.
- Grand Coulee Dam, Wash.
- All-American Canal, Calif.
- Central Valley project.
- Dams built by the bureau.
- Irrigation canals.
- The story of reclamation (from snowcapped mountains—source of water supply—to the completed project).
- Features of a typical reclamation project.
- Unusual construction features in the field of engineering.
- Agricultural economics in Federal reclamation.
- Recreational features on reclamation projects.
- Civic development on reclamation projects.
- Specialized crops grown on reclamation projects.
- Irrigation practices.

These exhibits consist of 8- by 10-inch prints, with titles, which may be conveniently mounted by the use of thumb tacks on bulletin boards or composition board which may be readily moved from place to place. The number of views is more or less governed by the subject matter, but a minimum of 12 prints is furnished on each subject. If more prints are desired on a particular subject they will be furnished on request, or a combination of subjects may be asked for to secure the desired subjects and number of prints. These exhibits are sent without cost and Government franks furnished for their return.

SALON PRINTS

Another type of exhibit is made up of salon prints of an average size of 16 by 18 inches. At present salon prints are limited both as to number and subject as follows:

- Boulder Canyon project, 67 prints.
- Columbia Basin project, 88 prints.

LANTERN SLIDES

Sets of lantern slides, of around 50 slides each, cover the following subjects:

- The Story of Reclamation by Irrigation from the sagebrush desert to the completed farm.
- Boulder Dam.
- Grand Coulee Dam—Columbia Basin Project.
- The Colorado River and the Southwest.
- Unusual Construction Features on Federal Reclamation Projects.
- Industries on the Irrigation Projects.
- Project Scenic Attractions.
- Zoology and Botany on the irrigation projects.

These slides will be loaned for brief periods to individuals and organizations. A lecture of about 3,500 words has been prepared to accompany the various sets. Persons borrowing slides must pay transportation charges both ways and agree to return them promptly and in good condition.

MOTION PICTURES

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(Continued on p. 228)

Reclamation Organization Activities and Project Visitors

John C. Page, Commissioner of Reclamation, left Washington on August 30 for the West, which will take him to several field and project offices for conferences connected with the Bureau's construction program, the largest undertaken since adoption of the Federal reclamation policy in 1902.

In Salt Lake City Mr. Page attended on September 3–4 a conference of western water consultants of the Water Resources Committee, of which he is a member, and on September 14–15 he will be present at the annual meeting of the Federal Irrigation Congress at Caldwell, Idaho, and deliver an address on "The Relationship Between the Bureau of Reclamation and Its Water Users." He will confer in Denver with R. F. Walter, Chief Engineer, concerning the 1937–38 construction program, and will spend 3 days on the Central Valley project in California, where a large-scale construction schedule is expected to begin this fall. Mr. Page expects to return to Washington about September 21.

During the absence of the Commissioner, Roy B. Williams, Assistant Commissioner, was designated Acting Commissioner.

J. Kennard Cheadle reported for duty as Chief Counsel and Assistant to the Commissioner on September 1. On September 4 Mr. Cheadle left Washington

COMMISSIONER PAGE GREETING ROY B. WILLIAMS, NEWLY APPOINTED ASSISTANT COMMISSIONER

for the west coast to confer with B. E. Stoutemyer, district counsel at Portland on the Sunnyside case. He also visited Yakima while on the coast.

R. F. Walter, chief engineer, and B. E. Stoutemyer, district counsel, Portland, visited the Boise and Vale projects in July. Mr. Walter was also a visitor on the Humboldt project and, accompanied by the construction engineer, inspected Rye Patch Dam and the river improvement work at Battle Mountain. Later the chief engineer made an inspection of the construction work in progress at Boca Dam. The Central Valley project and Yakima were also included in Mr. Walter's July itinerary.

L. N. McClellan, chief electrical engineer with headquarters in Denver, was elected to the office of vice president at the annual conference of the American Institute of Electrical Engineers held in Milwaukee, Wis., June 21–22.

L. H. Mitchell, field supervisor of operation and maintenance in charge of district no. 4, spent several days during July on the Minidoka project and visited a number of farms on the Gravity, Pumping, and Gooding divisions, where he demonstrated methods for determining the moisture content of soils by use of probes.

Alfred R. Golzé, supervising engineer, CCC, Washington Office, left headquarters for the West on August 8. Mr. Golzé will visit the CCC camps and reclamation offices located in the northern projects and will probably return to Washington on October 1.

A. H. Gullickson, former chief accountant of the Bureau of Reclamation and now holding an important position with the Internal Revenue Service with headquarters at Los Angeles, visited the Truckee Storage project, Nevada, in July.

The consulting board of engineers, consisting of Dr. W. F. Durand, Joseph Jacobs, and J. L. Savage, were visitors on the Provo River project on July 27, when they spent some time at the Deer Creek dam site and inspected the various features of the proposed dam and appurtenant works.

The following status changes have been authorized by the Secretary of the Interior:

Minidoka project:

Dana Templin from acting superintendent to superintendent.

All-American Canal:

Hudson Neil Britton from levelman to junior engineer.

The following recent appointments have been authorized by the Secretary of the Interior:

Washington office:

Walter J. Raleigh, draftsman; Walter R. Ulrey, assistant photographer, Public Relations Division (detailed to the Motion Picture Division).

Boulder Canyon project:

Perry W. Copple, Charles D. Norris, and Carlyle Wayne Shartle, timekeepers; Erwin H. Schoppe, senior clerk; Theodore R. Garrett and Earl R. Oxtoby, clerks; Norwood A. Doud, assistant clerk; James D. French, Thomas R. Parker, William H Price, and Walter G. Watts, storekeepers; William A. Riley, assistant storekpeeper.

Central Valley:

William G. Irving, consulting appraisal attorney; Miss Marie F. Dachs, assistant clerk, by transfer from the United States Engineer's Office, War Department, Fort Peck, Mont.; Miss Elsie M. Raymond, junior clerk; Perry G. Dodd, assistant clerk, San Joaquin Pumping System Office in or near Tracy, Calif., formerly employed in the Engineering Department at Large, War Department, Portland, Oreg.

Columbia basin:

Donald B. McLaren, assistant engineer; Lloyd V. Arant, assistant clerk, formerly employed in the office of the District Engineer, War Department, Portland, Oreg.

Parker Dam:

Clifford Clyde Matheny, inspector.

Minidoka:

Archie W. Heath, reservoir superintendent, vice H. E. Fields.

Yakima:

Fred W. Diener, reservoir superintendent, by change in designation from Gatender with auto.

Belle Fourche:

Miss Amy Irene Crisman, junior clerk, vice Luella C. Wickre, resigned.

All-American Canal:

Benjamin J. Williams, senior clerk formerly in the Indian Irrigation Service, Coolidge, Ariz.

Salt River:

Richard B. Black, assistant engineer.

The following transfers have been authorized by the Secretary of the Interior:

From Denver:

John P. Ottesen, junior engineer, to Boise project; LeRoy K. Thompson, inspector, to Ambridge, Pa., in connection with inspection work for the Bureau.

To Denver:

James L. Darnell, Jr., associate geologist, from Colorado River project, Aust'n, Tex., to Eastern Slopes Surveys (Denver); Milton J. Evans, from scientific aide in National Bureau of Standards, Riverside, Calif., to junior engineer, vice Dolph Campbell.

To Grassy Lake Dam, Upper Snake River project:

I. Donald Jerman, engineer, from associate engineer, Taylor Park Dam, Uncompahgre project.

To Central Valley project:

George C. Imrie, engineer, from associate engineer, Ogden River project; George R. Fulton, junior engineer, from Owyhee project to San Joaquin Pumping System, Tracy, Calif. (Central Valley); Russell Vinsonhaler, inspector, from Owyhee project, to Contra Costa Division (Central Valley).

To Buffalo Rapids project, Mont.:

Roger R. Robertson, engineer, from Gallatin Valley Surveys, Bozeman, Mont.; Wade L. McClure, junior engineer, from Rio Grande Investigations, Pagosa Springs, Colo.; William A. Werner, instrumentman, from Rio Grande Investigations, Pagosa Springs, Colo.

8-Year-Old Boy Drowned on Minidoka Project

Freddie Lott, of Declo, Idaho, an 8-year-old boy, was drowned in the second lift canal of the south side pumping division, Minidoka project, on July 22. The body was found 5 days later.

Public Relations Service

(Continued from p. 225)

the shipment weighs 4 pounds or under (two 16 mm reels or less) it will be sent to the borrower under Government frank, and the borrower is required to return it parcel post or express prepaid. All film shipments weighing over 4 pounds (3 or more 16 mm reels and any number of 35 mm reels) will be sent express collect and must be returned express prepaid.

Reels on the following subjects are available:

	Sound	Silent
Boulder Dam (Construction from start to finish).	4 reels, 16 mm. 4 reels, 35 mm	5 reels, 16 mm. 5 reels, 35 mm.
Grand Coulee Dam (the Columbia Basin project).		2 reels, 16 mm. 2 reels, 35 mm.
Great Salt Lake Basin, Utah.		2 reels, 16 mm. 2 reels, 35 mm.
Reclamation in the arid West.	1 reel, 16 mm.	

U. S. GOVERNMENT PRINTING OFFICE 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

THEODORE A. WALTERS, FIRST ASSISTANT SECRETARY, in charge of reclamation

John C. Page, Commissioner

Roy B. Williams, Assistant Commissioner

J. Kennard Cheadle, Chief Counsel and Assistant to Commissioner; Miss Mae A. Schnurr, Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr.; Wesley R. Nelson, Chief, Engineering Division; P. I. Taylor, Assistant Chief; A. R. Golzé, Supervising Engineer, C. C. C. Division; William F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk, Jesse W. Myer, Chief, Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner.

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, C. C. C. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz	Leo J. Foster	Constr. engr	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif
Burnt River	Unity, Oreg	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex
Alamogordo Dam	Fort Sumner, N. Mex	Wilfred W. Baker	Constr. engr		do	Do.
Central Valley	Sacramento, Calif	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Frenchtown, Mont				W. J. Burke	Billings, Mont.
Gila	Yuma, Ariz	Leo J. Foster	Constr. engr		R. J. Coffey	Los Angeles, Calif
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev	Stanley R. Mareau	Resident engr. [2]	George B. Snow	do	Do.
Kendrick	Casper, Wyo	H. W. Bashore	do	C. M. Voyen	W. J. Burke	Billings, Mont.
Klamath	Klamath Falls, Oreg	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont	H. V. Hubbell	Constr. engr	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Superintendent	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
North Platte	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah
Orland	Orland, Calif	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif	E. A. Moritz	do	George W. Lyle	R. J. Coffey	Los Angeles, Calif
Pine River (Vallecito Dam)	Bayfield, Colo	Charles A. Burns	do	John S. Martin	J. R. Alexander	Salt Lake City, Utah
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex
Caballo Dam	Caballo, N. Mex	S. F. Crecelius	Constr. engr	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Bull Lake Damsite	Riverton, Wyo	Arthur P. Smyth	Resident engr		do	Do
Salt River	Phoenix, Ariz	E. C. Koppen	Constr. engr	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
Shoshone	Powell, Wyo	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont
Heart Mountain	Cody, Wyo	Walter F. Kemp	Constr. engr	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont	A. W. Walker	Superintendent		do	Do
Truckee River Storage	Reno, Nev	Charles S. Hale	Constr. engr [2]	George B. Snow	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg	C. L. Tice	Reservoir supt		B. E. Stoutemyer	Portland, Oreg
Uncompahgre: Taylor Park	Gunnison, Colo	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo	C. B. Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage [3]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C. C. Ketchum	Superintendent		do	Do
Yakima	Yakima, Wash	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza division	do	Charles E. Crownover	Constr. engr	Alex S. Harker	do	Do
Yuma	Yuma, Ariz	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting. [3] Island Park and Grassy Lake Dams

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division) [1]	Lower Powder River irrigation district	Baker, Oreg	A. J. Ritter	President	F. A. Phillips	Keating
Bitter Root [4]	Bitter Root irrigation district	Hamilton, Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton
Boise [1]	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Do. [1]	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M. Watson	Caldwell
Grand Valley, Orchard Mesa [3]	Orchard Mesa irrigation district	Grand Jctn., Colo	C. W. Tharp	do	C. J. McCormick	Grand Jctn
Huntley [4]	Huntley irrigation district	Ballantine, Mont	E. E. Lewis	Manager	H. S. Elliott	Ballantine
Hyrum [3]	South Cache W. U. A	Hyrum, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan
Klamath, Langell Valley [1]	Langell Valley irrigation district	Bonanza, Oreg	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly [1]	Horsefly irrigation district	do	Henry Schmor, Jr	President	Dorothy Eyers	Do
Lower Yellowstone [4]	Board of Control	Sidney, Mont	Axel Persson	Manager	O. B. Patterson	Sidney
Milk River, Chinook division [4]	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity [1]	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping [1]	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding [1]	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands [3]	Truckee-Carson irrigation district	Fallon, Nev	W. H. Wallace	do	H. W. Emery	Fallon
North Platte: Interstate division [4]	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	do	Flora K. Schroeder	Mitchell
Fort Laramie division [4]	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering
Do [4]	Goshen irrigation district	Torrington, Wyo	Bert L. Adams	do	Mary E. Harrach	Torrington
Northport division [4]	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J. Thompson	Bridgeport
Okanogan [1]	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan
Salt Lake Basin (Echo Res.) [3]	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	do	D. D. Harris	Layton
Salt River [2]	Salt River Valley W. U. A	Phoenix, Ariz	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland division [4]	Shoshone irrigation district	Powell, Wyo	M. P. McLaughlin	Irri. superintendent	Geo. W. Atkins	Powell.
Frannie division [4]	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Superintendent	Lee N. Richards	Deaver.
Strawberry Valley [3]	Strawberry Water Users' Assn	Payson, Utah	S. W. Grotegut	Manager	E. G. Breeze	Payson.
Sun River: Fort Shaw division [4]	Fort Shaw irrigation district	Fort Shaw, Mont	E. J. Gregory	do	E. J. Gregory	Fort Shaw
Greenfields division [4]	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division [1]	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D. Martin	Hermiston.
West division [1]	West Extension irrigation district	Irrigon, Oreg	A. C. Houghton	do	A. C. Houghton	Irrigon
Uncompahgre [3]	Uncompahgre Valley W. U. A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose
Yakima, Kittitas division [1]	Kittitas reclamation district	Ellensburg, Wash	V. W. Russell	Manager	G. L. Sterling	Ellensburg

[1] B. E. Stoutemyer, district counsel, Portland, Oreg. [2] R. J. Coffey, district counsel, Los Angeles, Calif. [3] J. R. Alexander, district counsel, Salt Lake City, Utah. [4] W. J. Burke, district counsel, Billings, Mont.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo	P. J. Preston	Senior engineer
Columbia Basin Economic Survey	Coulee Dam, Wash	F. A. Banks	Construction engineer
Colorado-Big Thompson	Denver, Colo	Mills E. Bunger	Engineer.
Gallatin Valley	Bozeman, Mont	B. R. Robertson	Do.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo	Frank C. Merriell	Do
Black Hills	Denver, Colo	E. L. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	do	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	L. O. Larson	Do
Canchas	Tucumcari, N. Mex	J. A. Keimig	Associate Engineer.
Grande Ronde	La Grande, Oreg	C. C. Fisher	Engineer.

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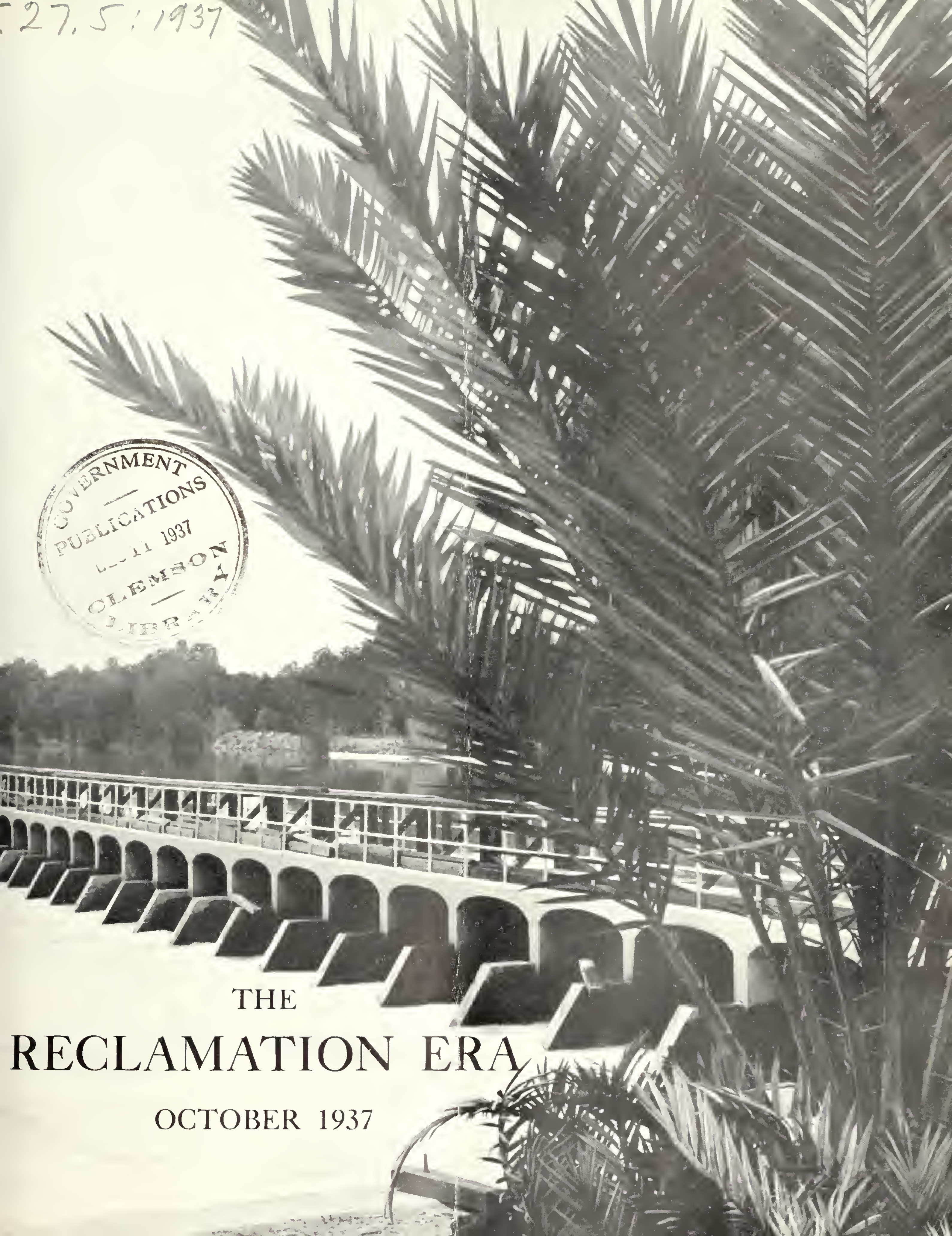
SALLIE A. B. COE, *Editor.*



THE

RECLAMATION ERA

OCTOBER 1937

COUNTRY IS CONSERVATION-MINDED

The experiences of the drought and the property damage and loss of life from floods linger in the memory of the Nation, and as a result more advocates of conservation of national resources have joined the already enthusiastic ranks of the constructive planners who stand solidly behind a program of construction of permanent improvements. To use the thought expressed by President Roosevelt at Chicago the first week in October, the United States is a peace-loving country and we want to spend our money on good roads, dams, reforestation, soil-erosion control—all national assets—in preference to the maintenance of an Army and a Navy of wartime strength and the manufacture of wartime materials.

President Roosevelt, an enthusiastic conservationist, said in his Constitution Day address, "In our generation a new idea has come to dominate thought about government—the idea that the resources of the Nation can be made to produce a far higher standard of living for the masses if only government is intelligent and energetic in giving the right direction to economic life."

This thought was in his mind on his tour of the Northwest the early part of October, and in almost every speech given along the route of his travel, he emphasized conservation. At Havre, Mont., on October 3, in an extemporaneous speech, he stated, "The time has come to use our WPA work not in building any more armories, or school stadiums, or streets, but to put it into the building of dams. Yesterday I saw the largest concrete dam in the world (referring to Grand Coulee Dam in Washington). All of these dams are intended to give the people a better chance—I believe that is what the American people want and are going to get."

The Department of the Interior, having grouped under it, as bureaus, important conservation units, naturally is pleased with this increasing interest in conservation.

JOHN C. PAGE, *Commissioner.*

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VOL. 27, NO. 10

OCTOBER 1937

Messages to the Annual Meeting in Casper, Wyo., on October 12–13, of the National Reclamation Association, addressed to O. S. Warden, President

By President Franklin Delano Roosevelt

I AM happy to have this opportunity to address through you the Sixth Annual Convention of the National Reclamation Association.

The Federal Government now is engaged in the West in its greatest program of construction of irrigation works. More than a score of dams, ranging in size from the great Grand Coulee Dam on the Columbia River in Washington to comparatively small earthen structures, are being erected to conserve and make useful the waters of western streams, large and small. These are scattered throughout the arid and semiarid States.

Many of these projects will serve as additional protection from the onslaughts of nature for lands already developed. The persistent and tragic droughts which during recent years have afflicted all the West in varying degrees have made it imperative that what can be done, consistent with good economic and engineering practices, shall be done to provide more reliable water supplies for the irrigated areas upon which the West so largely is dependent.

In some instances, Federal irrigation projects now under construction will bring new acreages into cultivation. These areas are not large, but they will serve, when they are ready for settlement, to bolster further the economic structures of the Western States. During the past year demand for new farming opportunities under irrigation canals in the West has exceeded a hundredfold the offerings which the Bureau of Reclamation has been in position to make. This demand arises in part from the fact that the drought has dislodged part of the population in certain districts and in part because, except on newly irrigated land, there are few opportunities for the young men and young women of the West to make farm homes.

Well planned and expertly engineered, a new Federal irrigation project is a good investment for the Government. Under the reclamation law the cost of its construction must be repaid to the Federal Treasury. Once completed, the project continuously is productive of new wealth, enriching our communities, our States, and our Nation.

By Secretary Harold L. Ickes, Department of the Interior

THOSE participating in the Sixth Annual Convention of the National Reclamation Association at Casper, Wyo., should find a source of pride in the great progress currently being made in the conservation of water, the West's most important resource.

There is a general awakening to the fact that, under the leadership of Franklin Delano Roosevelt, a devoted conservationist, we as a Nation have turned our back on exploitation. The battle for a strong and continuing national conservation policy is all but won. If conservation enthusiasts everywhere will continue to work in harmony, we shall shortly find a new era at hand.

The importance of conserving for intelligent, beneficial use the scant waters of the arid and semiarid Western States is becoming well understood. The work of the Bureau of Reclamation, as reflected in the Boulder Dam, the Grand Coulee Dam, and other projects, has caught the attention of the Nation, stirred its imagination, and awakened a new interest which is rapidly breaking down sectional resistance to improvements in this field.

The work of the Water Resources Division of the National Resources Committee has prepared the way for a cohesive, long-range development and improvement program, the kernel of which is conservation in all its aspects related to water uses. Planning is assuming an importance never before attained in this connection.

Strong support is present for a change of the name of the Department of Interior to the Department of Conservation. When accomplished, this will mean that conservation will have been recognized as a major activity of the Federal Government, meriting representation through an administrative department in the Cabinet of the President of the United States. This positive declaration of our national intentions should be a major objective of all conservationists.

Organizations such as the National Reclamation Association, vocalizing in every field the determination of the present generation to abandon shortsighted, selfish, and ruthless policies in favor of those more generous to the future, must be vigilant if we are to succeed.

I wish for you a successful meeting.

17032 37——1

Progress and Problems of Federal Reclamation

By John C. Page, Commissioner of Reclamation [1]

THE position of Federal reclamation this year is stronger than in many of the past years. Our great construction program is moving forward rapidly and efficiently. The operating projects are prosperous and agitation for moratoria on repayment charges is disappearing. The outlook is encouraging also in that by and large the whole Nation has a better understanding of our efforts and is gaining more respect for our achievements.

There are still problems, however, which need the earnest consideration of the entire West. No year in which a major drought affects a vast area of the West can be a year of jubilation, despite return of confidence and good progress. This year, therefore, should be one in which we dedicate ourselves to hard work buoyed by the hope and belief that cooperation is bringing results, that many of our obstacles have been overcome, and that the problems lying ahead are not beyond solution.

One of the outstanding achievements of the year is to be found in the surging movement toward a firm and continuing national policy of conservation of our natural resources. This is of particular significance to the arid and semiarid States where conservation and prudent use of water, the greatest resource here, occupies so much of our thought.

President Franklin Delano Roosevelt in his Constitution Day address at Washington summed up the situation when he said, "In our generation a new idea has come to dominate thought about government—the idea that the resources of the Nation can be made to produce a far higher standard of living for the masses, if only government is intelligent and energetic in giving the right direction to economic life."

Under the guidance of Secretary Harold L. Ickes, who also is Chairman of the National Resources Committee, the Department of the Interior has taken the lead in broader planning and encouraging more intelligent use of our natural resources. To him must go a major share of the credit for the current awakening of the Nation as a whole to its conservation problems and the present determination to do something about them.

The work in the field of water conservation and control done by the Water Resources Division of the National Resources Committee during this year has been one of outstanding importance. It has pointed the way for advancement on a national front through the formulation of long-range plans based on drainage basins—and this must be our ultimate goal.

It was gratifying to the Bureau of Reclamation, and I am sure it must have been also to the entire West, to find that in its monumental work the Water Resources Committee gives irrigation a prominent place in the new picture of the development of our country.

The marshalling of these forces for a broader attack has done much and will do more to break down sectional prejudices. The peculiar problem of the arid and semiarid West, therefore, is receiving more sympathetic consideration in remote sections of our country, just as the West is becoming more sympathetic toward those faced with floods of the Ohio Valley and polluted streams in New England.

Last year I spoke of the need for consideration of a large group of small storage projects to serve isolated communities scattered through the West—communities of a few farms or ranch headquarters which mean so much to the stability of these vast States but are feeling the pinch of drought and are threatened with dissolution. I am pleased that the Congress passed and the President approved a bill authorizing an appropriation of $500,000 to the Bureau of Reclamation to undertake a group of these projects for demonstration purposes and on an experimental basis. It is to be regretted that this bill was enacted too late during the recent session of the Congress to make it possible to obtain the appropriation and to begin the work at once. However, the appropriation may be made during the next session of the Congress and we are at this time laying the groundwork for selection and construction of a series of these small projects, each to cost less than $50,000. I believe this work holds much promise for the future.

APPOINTMENT OF COMMISSIONERS TO STUDY RECLAMATION PROBLEMS

Last year, also, I discussed a general investigation of the repayment methods of the Bureau of Reclamation for the purpose of arriving, if possible, at a more equitable basis for collection of the construction charges. I am pleased also that a bill has been enacted directing the appointment of a commission by the Secretary of the Interior to make this study. Very shortly this commission will begin its work. Careful plans have been laid in an effort to make sure that the commission will have the opportunity to study the problem of every project where difficulties exist. Under the law the commission has the authority to review the status of the projects and to recommend to the Secretary the postponement of such parts of the 1937 construction repayments as may be justified by actual conditions and the ability of the water users to pay in the various localities. It also has the job of devising an equitable, flexible, and workable repayment system for all the projects, which it is to be hoped in the future will make it unnecessary ever again to resort to blanket moratoria. The commission has the further duty of making a general economics survey of our projects. The assignment is large but I trust it will be well done.

Projects in construction, which had been started by emergency-fund allotments but for the completion of which additional funds were needed, successfully passed their major test before the Congress. Appropriations were made which will insure that all will go forward during the 1938 fiscal year.

The situation with regard to the two major projects of our present program was clarified. Last year there was no decision on the question whether the construction of the Grand Coulee Dam should proceed beyond the foundation stage. This year the Congress appropriated funds for its continuation and very shortly we plan to call for bids for completion of the Grand Coulee Dam to its full height of 550 feet.

Last year there were imperfections in the authorization for the great Central Valley project in California. The Rivers and Harbors Act of 1937 corrected this, and most of the principal difficulties in the way of early commencement of large-scale construction on this undertaking have been removed.

Appropriations for these two projects, and for the Boulder Dam and the All-American Canal, which were authorized by the Boulder Canyon Project Act of 1928, were made from the General Treasury. Appropriations totaling $9,850,000 for continuing construction of 18 additional projects, however, were made from the reclamation fund. Many of these projects will not be completed with the appropriations made this year; yet, at the close of this fiscal year the reclamation fund will be depleted.

FINANCING RECLAMATION

This brings us face to face with what I consider the most pressing of the problems now before Federal reclamation. Income to the reclamation fund which may logically be expected this year will not be sufficient to carry on next year a

[1] Address delivered Oct. 12 at annual meeting in Casper, Wyo., of National Reclamation Association.

program of the size now under way and which has been tied to this fund. You are all familiar with the conditions which have resulted in curtailment of the income to the reclamation fund. The sale of public lands has all but ceased. Moratoria on construction repayments have prevented accumulation of a surplus in the fund during the years when construction was financed by allotments from other sources.

It is most encouraging to find little sentiment anywhere for continuation of the blanket moratoria, but construction repayments alone will be insufficient to meet the requirements next year. Repayments will provide only about $4,000,000 of the $10,000,000 or $12,000,000 which will be needed. Other sources upon which we now draw under the law can be expected to yield little more than $2,000,000 in accretions. This will leave quite a wide gap. Some means must be found to fill this gap if the program is to continue with reasonable speed.

Two alternate courses have been suggested. One would lead to the elimination of the reclamation fund as a special fund, and would require appropriations for all these projects direct from the General Treasury with all repayments to return direct to the General Treasury. The other which I favor would lead to retention of the reclamation fund, with dependence upon advances from the General Treasury or the discovery of some new revenues.

There are advantages to retention of the reclamation fund as a special fund which may occur to all of you. Certainly if Federal reclamation is the good investment which we believe we have demonstrated it to be, some means of financing this work will be found. This matter must have the attention of all the West.

This year the first four generators in the Boulder Dam power house went into operation, making the Bureau of Reclamation the most important governmental agency in the field of power production. Power plants on 12 projects produced totals averaging more than 100,000,000 kilowatt hours of hydroelectric energy each of the 12 months before September this year. The highest production in any 1 month up to that time by the Bureau's power plants was reached in August after a gradual rise throughout the year, when 152,722,123 kilowatt hours were produced and sold. The production curve still is rising.

We have under construction at this time additional projects which will produce power as a byproduct and which eventually will increase many times our total annual output. The first of these plants was constructed by the Bureau more than 30 years ago as a means of assisting in the construction of an early project. Later power installations were made on other projects to provide energy for pumping as a part of the irrigation systems. More recently, since we have undertaken large dams for the control of entire rivers and watersheds, power plants have been included in our plans as integral parts of the projects as at Boulder Dam, Grand Coulee Dam, Seminoe Dam on the Kendrick project here in Wyoming and Shasta Dam of the Central Valley project in California. To have omitted these plants would have been to overlook an opportunity to obtain higher use of water conserved and to fail to meet the social obligation to provide the people, where we can, with cheap energy to improve their lot.

TWO TYPES OF PROJECTS

Almost from the beginning of Federal reclamation, two types of projects have been constructed. One is designed to rescue developed irrigation communities through rehabilitation and through provision of adequate, regulated stored water supplies, and the other is designed to expand the agricultural base of the arid and semiarid States by watering new desert lands and thus creating new opportunities for homemakers.

It was inevitable that any major drought should place unusual emphasis upon the rescue or remedial projects, because drought emphasizes the weaknesses in existing water systems. It is essential, however, that we, as a Nation, do not lose sight of the more fundamental purpose of this work.

At Cheyenne recently in an informal talk from the rear platform of his train and again in his address at Bonneville Dam, President Roosevelt pointed to the need for providing new opportunities for those who have been uprooted by the drought in the Great Plains or by exhaustion of their resources on poor lands in other areas. Since the present drought began in 1930, conservative figures disclose that more than 100,000 farm families have abandoned their homes and moved westward seeking the security of a firm and reliable irrigation water supply for their transplanted homes. There have been no such number of farms available out here in the arid and semiarid States, and in great numbers these unfortunate people have gravitated to the relief rolls of the western cities.

The President said at Cheyenne, "And so, for these families, I believe it is the duty of the Federal Government and the State governments to provide them with land, where it is possible to do it, where they can make a living."

In addition to these, young men and young women from the farms of this western country, reaching the time in their lives when they wish to make homes for themselves, need opportunities which will permit them to remain on the land.

Let us hope that the facts and the manner in which the President has focused the attention of the Nation upon them have eliminated entirely the opposition to this work which hides behind the spurious argument that to irrigate additional lands in the West is in conflict with the broad agricultural program of the Nation. This is not true and never has been true.

There has never been too much land under cultivation in these Western States. There has always been a crying need for more, just as there is at this time when tens of thousands must go homeless. These States are limited in their agriculture by meager natural waters. Irrigation is essential here if farming is to be practiced at all. These western irrigated lands do not add to surpluses of the great staple crops. Last year the Federal reclamation projects produced only one-tenth of 1 percent of the total corn crop of the United States; only seven-tenths of 1 percent of the total wheat crop; only 1.4 percent of the total cotton crop and no tobacco at all. Their production of corn, wheat, and cotton was insufficient to supply their own needs, and much was imported to them from areas where these crops dominate.

Irrigation farming is diversified farming, by which the farmer produces for his own consumption and sells the surplus in local markets; or it is farming for the production of specialty crops which supplement but do not compete with the production of any other section of the United States.

At this time we are engaged in construction of 12 projects which upon their completion ultimately will bring 2,105,040 acres of new, desert lands into production. Of this total, 1,200,000 acres are in the Columbia Basin project, the first unit of which will not be ready for settlement within 5 years and the last unit of which will hardly be completed within 30 or more years. It will be possible for the Bureau of Reclamation to offer water next year for the irrigation of only a few thousand acres of new land. It will be possible to increase these offerings slightly in following years, but the present outlook is that at no time in the next 10 years will we be able to offer for settlement more than 150,000 acres in any 1 year.

I wish, for the sake of those who seek homes, that a brighter picture could be presented to them in connection with Federal Reclamation developments.

SETTLERS TO BE PROTECTED

When these lands are made available, however, every effort will be made to

(Continued on p. 252)

A Department of Conservation

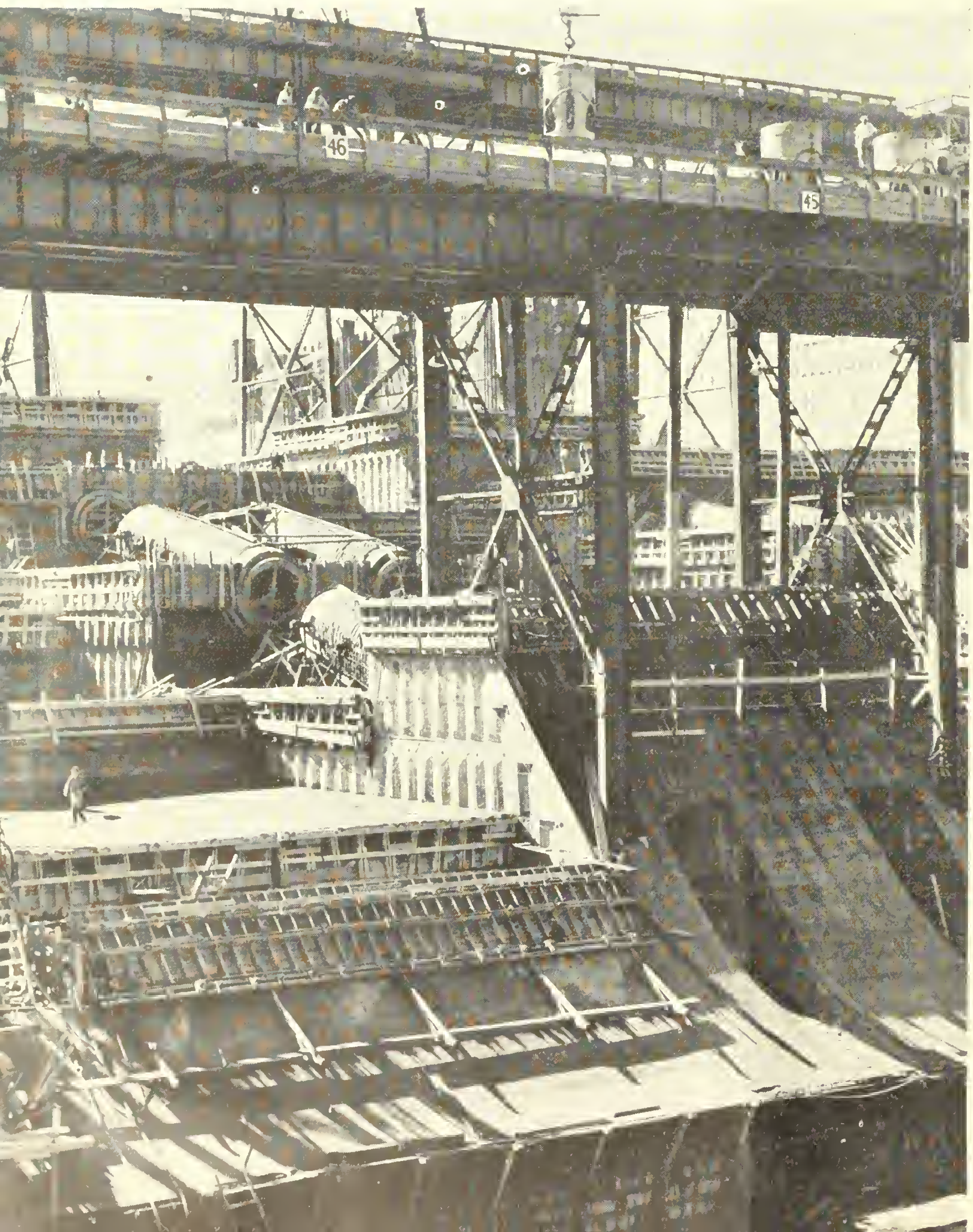
By Hon. Harold L. Ickes, Secretary of the Interior [1]

BIRTH is always a portentous event to a family. Accordingly, the birth of the home department of the Government, which was the original designation of the Department of the Interior, should be interesting to the great American family, as well as to students of political economy. Since my theme tonight is the doings of the Department of the Interior, it is fitting that we should examine into its nativity.

There is no branch of the Government more closely related to the development of the United States and to the personal welfare of the people than the Department of the Interior. The original colonies, and subsequently the Federal Government, could offer seemingly inexhaustible quantities of land amply supplied with water, minerals, forests, and wild life, which constituted the basis of the pioneer economy. The Congress, in the days of flush exploitation and eager settlers, created the Department of the Interior, specifically as the home department, for the purpose of developing and utilizing our natural resources by making them available for settlement.

As a result, the Department of the Interior has been largely responsible for the transformation of the West from arid, unproductive areas into fertile farms and populous towns, which afford profitable markets for eastern manufacturers. Under the guidance and control of the Department, vast mineral wealth has been uncovered and utilized. Without this epoch of discovery and utilization of our national wealth, the West, in large part, would still be barren and our eastern industrial development would better be described as a principality rather than an empire.

The need for such an agency as the Department of the Interior was early recognized. It was proposed in the first Congress, in 1789, that, in addition to the departments of Foreign Affairs, War, and Treasury, there should be a home department, which seemed to be necessary "by (reason of) the magnitude of the territorial possessions of the United States and the domestic affairs." This proposal was voted down because in the then "deranged condition" of the Federal finances any expenditure which could be avoided was put aside.



COLUMBIA BASIN PROJECT. DETAILS OF CONSTRUCTION AT GRAND COULEE DAM. OUTLET WORKS IN VARIOUS STAGES.

DEPARTMENT OF THE INTERIOR CREATED IN 1849

Bureaus established.—The proposal was renewed in 1816 by President Madison and again by President Monroe in 1824. Recurring through successive years, it was not until 1849, sixty years after it was first suggested, that the home department, or the Department of the Interior, was created. The nucleus of the fledgling department consisted of the General Land Office, transferred from Treasury; the Bureau of Indian Affairs and the Pension Office, transferred from the War Department; and the Patent Office, transferred from State.

The principal wealth of the new Republic consisted of the vast public domain, unsettled and unused. The public lands were regarded as property for sale that was to be disposed of for revenue. They provided, in short, the ways and means to support the new Government and to promote national prosperity. The Congress early enacted laws making liberal donations of public lands to the several new States, as they were admitted to the Union, for the support of education and for internal improvements.

Gradually there were created within or annexed to the Department of the Interior various companion agencies having to do logically with its principal purpose. The

[1] Address delivered in Washington, D. C., over Columbia Broadcasting System, August 20, 1937.

Geological Survey, with the function of classifying and mapping the public lands and examining their geological structure and mineral resources, was established in 1879. The Reclamation Service, charged with the duty of storing and dispersing water in the arid regions of the United States for use in agriculture, was established in 1902. The National Park Service was created as a unit of the Department in 1916 in order to protect and preserve such unique manifestations of nature found within our borders as had so far escaped the destructive impulses of the reckless pioneer. The Bureau of Mines was set up in 1910 to assist in the economic development of the mining industries. The Office of Education came into being in 1867 to be a factor in building up our human resources.

The administration of the Territories has always been an important problem of internal affairs. For many years these adolescent States reported to the Department of State, but in 1873 the duties previously exercised by the Secretary of State by law or custom were transferred to the Secretary of the Interior. As the country developed the Territories acquired political manhood, until today only two remain—Alaska and Hawaii, which are in the Department of the Interior, along with the insular possessions of Puerto Rico and the Virgin Islands. Recently three islands in the mid-Pacific, Wake, Howland, and Jarvis, which are important as airplane bases, have also found themselves under the maternal wing of Interior.

As the functions of government expanded and our population increased, bringing many new administrative and economic problems, it was natural that other departments should be created for the more specific handling of internal affairs than could be undertaken by a single department. As a result, the Department of Agriculture was established in 1862 for the purpose of acquiring and diffusing information on agriculture and to distribute seeds. Later, to perform special functions, the Departments of Commerce and Labor were established.

In a true democracy, policies of government can be nothing else than an expression of the composite thinking of the people. Different epochs formulate different theories to meet expression and the sentiment of the times. Changes for the better which germinate in the minds of the more forward-thinking individuals, require a long time to prevail against the weight of customary majority opinion. Theodore Roosevelt was one of the first to foresee ruin in the midst of the bountiful harvest of our natural resources. During my association with him I acquired something of his sound viewpoint on conservation. Long ago I came to realize that the cycle of reckless exploitation must come to an end and that as a Nation it was our duty to direct ourselves to the conserving of the unentailed remainder of our resources.

Such a policy is necessary, not entirely for the benefit of future generations, as has been urged by conservationists for several decades, but for the preservation and well being of the present population. Erratic rainfall, lowering water tables, soil erosion and dust storms alternating with floods, have already brought periodic or permanent disaster to great numbers of people and the threat of an uncertain future causes discouragement and weakens initiative among formerly prosperous groups whose livelihood has been affected by unfavorable natural conditions. The whole question of conservation is no longer one of idealism alone; it has become intensely practical.

The first settlers had to cut down the forests to build their cabins and to plant their crops. Granted that they cut too widely and with unnecessary recklessness, who then was in a position to say how far to the westward development should proceed, beyond what degree of longitude no one should have been allowed to pass, or what lands should have been opened to settlement? It must not be forgotten that the overwhelming sentiment of the country was directed toward satisfying a land-hungry population that looked upon America as a country of limitless opportunity. No one today, can justify many of the methods of our forebears in their reckless dissipation of our Nation's resources which the law required should be administered in a manner that encouraged profligacy and waste.

To me, conservation means the prudent use of our natural resources without waste or needless destruction and having in mind always that, so far as not inconsistent with our own needs, they should be preserved for the use and enjoyment of future generations of Americans.

It has long been my opinion that conservation can only be established on a sound and permanent basis by adopting it as a national policy and concentrating responsibility for it. Uniform principles would thus become established, economy of operation would mean greater accomplishments for the funds expended, and of more importance still, the danger of exploitation would be minimized because policy and precedent would create protective grooves that any temporary transgressor in public office would find it difficult to disregard.

In the minds of most people, especially those who live in the East, conservation means forests. The reason for this is that the policy of conservation of our natural resources as announced by Theodore Roosevelt when he was President related to forests. However, there are many phases of conservation, and some of these, from an economic point of view, are as important as forests.

CONSERVATION OF WATER

There is water, for instance. To those of us who live east of the Mississippi River, where sometimes there is too much rain with the result that disastrous floods occur periodically, it is difficult to conceive that water means economic life or death in a great third of the area of our country. In contrast to our efforts in the East to control a surplus of water that is often overwhelming, the supply in the West is so dangerously inadequate that water is almost literally counted by the drop. The threat of a water supply that is reduced to a point where it is no longer adequate has become an actuality in many places in the West due to increases in population and to overuse. In some areas there is practically no rainfall. What water there is, is obtained from stream beds which flow at flood during the spring when the melting snows in the mountains are released. This water, left to its natural state, rushes quickly to the sea so that the beds of the streams are dry for a large part of the year. By holding back this avalanche of water by dams or by diverting it through man-made channels, it preserves a valuable natural resource for the growing of crops.

How often have Senators and Representatives from Western States come to me to plead for more irrigation projects. "It is the gold of the West", they say. Many of these men are descended from adventurous forefathers whose original urge to brave the dangers of the arid and semiarid lands of the West was to find yellow metal. Long since precious gold has ceased to be the foundation of the prosperity of the West. Liquid gold, which is water, has taken its place.

Man's ingenuity in utilizing Nature's offering of water would amaze the pioneer who struggled through desert and forest to reach land's end on the Pacific three-quarters of a century ago. About 20,000,000 acres of land in the so-called arid and semiarid belt in 11 Pacific and Mountain States, as the result of irrigation, annually make an important contribution to the national economy. Directly and indirectly, these acres support 13,500,000 people and produce annual crops valued at $766,500,000. Without the great dams and irrigation ditches that have been built the mountain tops would still be sending their torrential floods to the ocean, a great part of the West would still be a barren desert, the Nation would be denied this considerable increase in its capital assets, and eastern industries

would be without the vast outlet for its products that the West furnishes today. This irrigation program the Department of the Interior has developed.

I have spoken of the beneficent influence of water, which, like a child, responds to the wise ministrations of man, as one of the practical aspects of conservation. There are many other phases, however, of this broad subject. When the forty-niners endured hardships to reach the yellow gold of California, an era of exploitation of our mineral wealth was begun. The very munificence of Nature's gifts to America encouraged profligacy in their use. If, by scratching the surface, one could skim the cream of the mineral deposit and move on to the next hoard that had been built up by the ages, there was no incentive to utilize that which offered greater resistance. Yet today, as the result of the perfection of machinery and of improvements in methods, the mining industry is securing profitable dividends by working over the grist left by the early miners.

We find another interesting story in the utilization of the forests with which America was once so generously supplied. For generations the unchecked lumbermen by clear-cutting destroyed not only the forests but the wildlife and rendered the watersheds ineffective for large areas. Then the Federal forest reserves were established for the protection of what remained of this valuable national asset. We still have clear-cutting in privately owned forests, but in our Federal reserves selective cutting is practiced, which allows the trees to reproduce and permits the lumbering of the ripe timber alone.

Taylor grazing law.—When the forerunners of the great cattle barons moved westward, they found lush grass on the ranges that reached to their horses' stirrups. Now, because of wanton misuse, the traveler sees only short blades so thinly scattered that it requires as many as 15 acres in some places to graze a single steer. After many years of effort by the Department of the Interior, the Taylor Grazing Law was passed by the Congress in 1934. Under this law we have set aside 142,000,000 acres of the most valuable of this land as a great grazing preserve under the direction and control of the Government.

It seems to me so obvious as not to require argument that conservation will be greatly advanced if it is made a major responsibility of a great Department of the National Government. Since I proposed to the Congress over 2 years ago that the name of the Department of the Interior be changed to that of Department of Conservation, I found to my surprise that our natural resources are divided into organic and inorganic, or nonrenewable and renewable resources. The inorganic are said by the critics of this proposed change to be for the most part minerals or subsurface resources. The organic group, on the ohter hand, they say, comprise those that grow from the soil, meaning agriculture.

Just what are the proposals of the President's committee concerning conservation in the reorganization plan of the executive departments? First, it says that conservation today represents a major purpose of our Government, and recommends that it be made a department of Government to replace the present Department of the Interior, as I proposed more than 2 years ago. As to the general purpose of the proposed Department of Conservation, the committee says that it is to advise the President with regard to the protection and use of the natural resources of the Nation and the public domain; to administer the public lands, parks, territories, and reservations; and enforce the conservation laws with regard to public lands and mineral and water resources.

The committee makes a wise observation regarding government, namely, that it is a going concern and not a static institution. "Each activity", it says, "had its period of initiation and development, and new activities should be organized rather completely on the basis of purpose so that that purpose may be the central driving force of the organization." This is exactly the opposite to what opponents of a consolidation of conservation activities would have it.

The purpose of government reorganization is administrative and not political; therefore, authority should be delegated to the Chief Executive, within general limitations, to go forward with it. Admittedly, it is a subject on which there can be a wide and honest difference of opinion, but with respect to the field of conservation there is no one so well qualified as is the President to pass final judgment.


COMPLETED PINE VIEW DAM, OGDEN RIVER PROJECT, UTAH.

Boulder a Mecca for Travelers

During the month of August 71,254 persons traveling in 21,791 cars were checked through the two checking stations operated by the National Park Service on the Boulder Canyon project. Fifty-seven thousand four hundred and sixty-one persons in 17,498 cars entered the Nevada gate and 13,793 persons in 4,293 cars entered the Arizona gate. During the period 20,040 persons in 5,349 cars were checked through the Lake Mead Station. Two hundred eighty-two persons in 102 vehicles visited the Overton district and 207 visited the Pierce Ferry area. Six planes carrying 19 passengers also visited the project.

Persons making the trip to the powerhouse via the elevators numbered 40,607, of which number 32,198 were paid admission; 7,493 were children under 16 years of age, and 916 persons, mostly employees, were not charged.

Shasta Dam Officially Named by Commissioner Page

Standing on the site selected near Kennett, Calif., for the giant storage dam that is to become the key unit of the Central Valley project, John C. Page, Commissioner of Reclamation, on September 12, officially named the proposed structure Shasta Dam, after the majestic snow-crowned peak that guards the northern extremity of California's Great Central Valley.

Shasta Dam, during the years of preliminary study and exploration, has been known as Kennett Dam, unofficially named after a railroad way-station in the Sacramento Canyon just above the dam site 13 miles from Redding, seat of Shasta County. The Commissioner pointed to the geographical and historical significance of the name "Shasta" and said present engineering designs for the structure will make it one of the world's largest concrete dams.

Mr. Page said:

"Large-scale construction on the $170,000,000 water-conservation project, already in the camp-building stage, has been hastened by action of the recent Congress in clearing legal obstacles to its authorization and appropriating an additional $12,500,000 for this year's work. The Central Valley project is remedial, not promotional. Therefore, it is a perfect example of the type of irrigation enterprise in which the Federal Government should interest itself.

"By providing better distribution of water in the semiarid interior valleys of California, the project will preserve or restore these rich areas already highly developed—areas representing a producing agricultural investment of $2,000,000,000 now facing decline or collapse because of an inadequate water supply.

"Shasta dam will rise over 450 feet above the bed of this river, to back up water more than 25 miles and create a reservoir with a storage capacity in excess of 3,000,000 acre-feet. The dam will be more than 2,500 feet long on the crest. From the white slopes of Mount Shasta itself will come some of the waters to be controlled and regulated at the dam for the benefits of irrigation, flood protection, navigation, industrial and domestic use, salt-water repulsion, and power generation in the valleys below.

"Mount Shasta, double-peaked extinct volcano towering 14,161 feet above sea level, is one of the Nation's highest and one of the world's most beautiful mountains. Its snowy crest was a familiar sight to settlers far down the State long before white men ever trod the green grass in the thick forests at its base. Today, from the dome of the State Capitol in Sacramento, one plainly can see Shasta's white top lifted proudly above the blue range that closes in the valley to the north.

COMMISSIONER PAGE DELIVERING ADDRESS AT KENNETT, CALIF., WHERE HE OFFICIALLY NAMED THE DAM TO BE CONSTRUCTED "SHASTA DAM."

"To the gold-seeking emigrants of the 50's, heading west across the deserts of Nevada, it was an infallible guide to lead them toward the mother lode of California. To mariners on the Pacific Ocean its glistening crown still is a convenient landmark easily sighted from far at sea.

"The Russians, who came to northern California in the first part of the nineteenth century, called it Tchastal—the white or pure mountain. One of the earliest Government maps of the West, based upon surveys made by Gen. John C. Fremont in 1848, designates the peak as Tshastl. Time and anglo pronunciation finally have made it Shasta—and selection of this name for the great dam soon to be built is appropriate recognition of the pioneers who founded the agricultural empire it is to serve."

Mr. Page was accompanied to Kennett by Walker R. Young, construction engineer of the Central Valley project, other officials of the Bureau of Reclamation and the State of California, and by civic leaders of Shasta County.

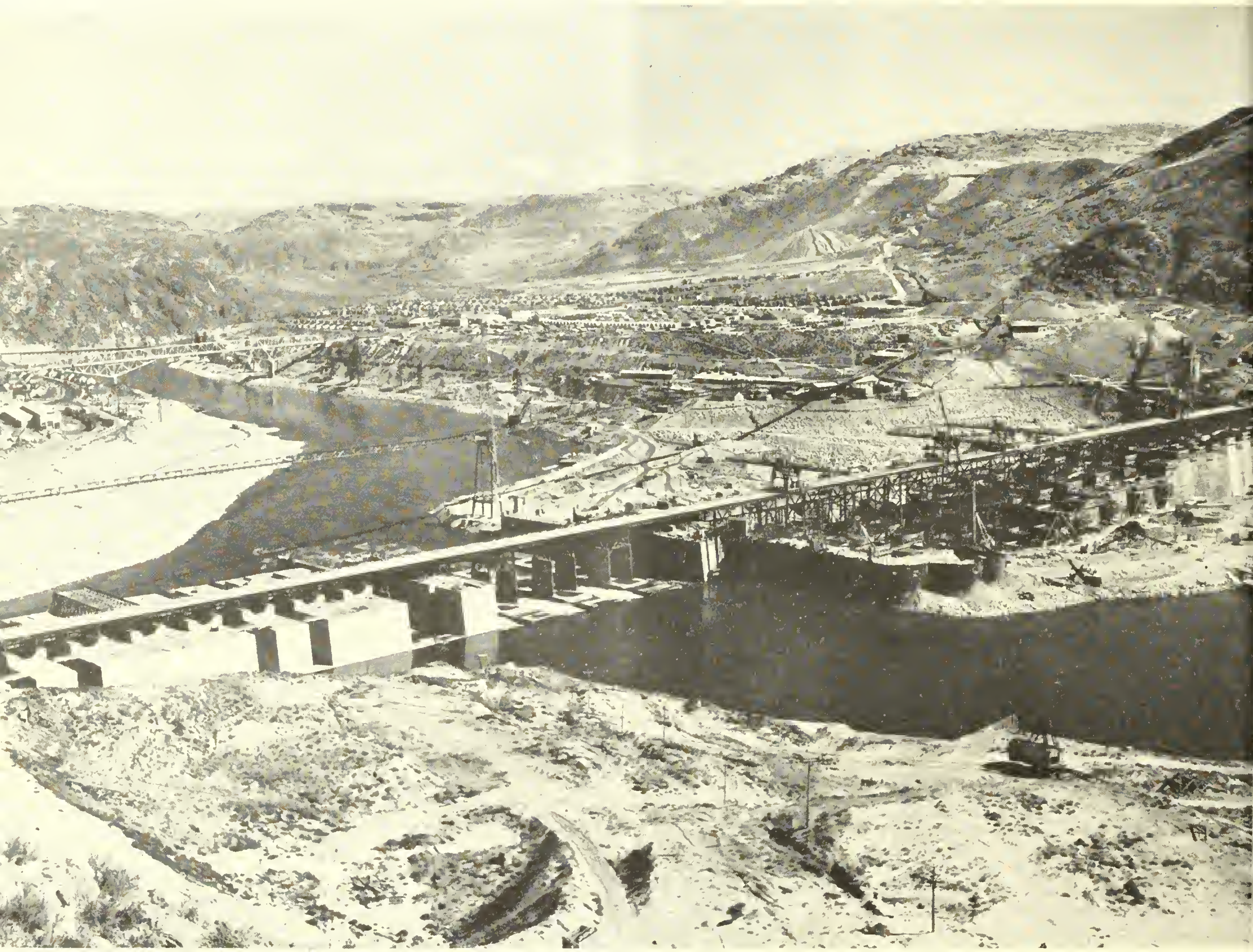
Mr. Young said the northern division of the project will continue to be known as the Kennett Division, and the Government camp being built near the dam site as the Kennett Camp.

Other divisions of the project are the Delta division and the Friant division. Construction is about to start under the Delta division on the Contra Costa fresh-water canal. At Friant, near Fresno, work is approximately 50 percent completed on erection of a Government camp to serve during construction of the Friant Dam and the Madera and Friant-Kern Canals.

Klamath Project Has Livestock Show and Sale

On August 30 and 31 the Junior Livestock Show and Sale was held at the county fair grounds at Klamath Falls, Oreg. The Four-H and F. F. A. clubs furnished about 300 exhibitors, and attendance and interest in the show and sale were exceptionally good. On the last day of the sale 200 head of the livestock were sold at auction at a sale value of approximately $8,000. Steers averaged 18 cents per pound, lambs 15½ cents, and hogs 14 cents. The 300 exhibitors were guests of the Rotary Club at a banquet at the Willard Hotel.

Grand Coulee Progresses



COLUMBIA BASIN PROJECT, WASHINGTON. GRAND COULEE DAM, LOOKING NORTHEAST ACROSS THE DAM TOWARD MASON CITY.

A TRAINLOAD of cement and seven trainloads of sand and gravel are poured each day into the maws of giant concrete mixers at Grand Coulee Dam, where an entirely new set of construction records are being made.

In mid-September 3,500,000 cubic yards of concrete had been placed in the dam, which is about a year ahead of schedule. With excavation completed, the MWAK Co., the contractor, is concentrating on placement of concrete, operating two mixing plants, one on the west and the other on the east wall of the Columbia River canyon.

The present contract, covering the construction of the foundation of Grand Coulee Dam to a height averaging about 177 feet above bedrock, is expected to be completed around January 1. The Bureau of Reclamation has in preparation specifications for a new contract, under which the dam will be completed to its full height of 550 feet. Bids have not yet been called, but the call may be issued within a few weeks.

New records have been hung up for manufacture and pouring of concrete in 1 day several times at Grand Coulee Dam, and the world's record established during the construction of Boulder Dam has been surpassed by about 50 percent. Before the dam in the Columbia River in eastern Washington was started, the most concrete which had ever been placed in a dam in 1 day was 10,642 cubic yards, the peak reached during construction of Boulder Dam. This record was exceeded at Grand Coulee Dam for the first time in May. The greatest single day's pour at Grand Coulee up to this time was made last month when 15,600 cubic yards were mixed and poured into the ever rising forms. During September a new high of 17,000 is expected soon after the last of the bedrock is covered.

Cement is now being received at the dam at the rate of about 95,000 barrels per week, or about 60 carloads a day. It comes from six cement plants scattered over the State of Washington.

Up to September 1, 15,295 carloads of cement had been received—enough to make a train 142 miles long. From the blending plant, high on the west canyon wall, where it is received, the cement is

forced by compressed air through 11-inch pipes to the mixing plants, one 2,000 feet and the other 6,200 feet distant. Through one of these pipes, half a train load crosses the Columbia River on a suspension bridge each day.

To make the huge quantities of concrete which are being handled at the dam, a gravel pit as big as a middle west farm is worked with enormous electric shovels which deliver more than 30,000 cubic yards of sand and gravel to a washing and screening plant every day. About 40 percent of the pit output goes to waste as excess sand, and, as a consequence, a waste pile of 2,000,000 cubic yards of sand has accumulated. Processed aggregate is delivered from the washing plant to main stock piles over a 48-inch belt conveyor 5,965 feet long—35,000 tons of it every day—700 carloads. Four and a quarter miles of conveyors are in use at the Coulee Dam, handling gravel.

From the streams of sand, cement, gravel, and water poured into the two mixing plants, automatic scales, controlled by electricity and compressed air, weigh out in a few seconds precise portions of each component to make a 4-yard batch of concrete. With a 2-minute mixing period, the eight mixers in the two plants produce uniform, high-strength concrete at the rate of a cubic yard in less than 5 seconds. A graphic record of the weight of each component and of the consistency of each batch is made automatically.

Glendive Unit, Buffalo Rapids Project, Mont., Allotted $1,605,000

An allotment of $1,605,000 has been made by President Roosevelt from funds made available by the Emergency Relief Act of 1937 for construction of the Glendive unit of the Buffalo Rapids project in the Yellowstone River Valley in Montana.

The purpose of the allotment as set out in the notice is as follows: "To provide work relief for persons in need by the prosecution and completion of a Federal project authorized under classification 'b' of said act (E. R. A., 1937) for the construction of pumping plant, canal, laterals, and structures of the Glendive unit for irrigation of land in the Yellowstone Valley adjacent to the city of Glendive, Mont.: *Provided*, That the expenditure of $776,000 of the foregoing allocation is to be made on a reimbursable basis. The prosecution of this project shall be subject to all the restrictions and limitations of said act."

The Glendive unit is a part of the more comprehensive Buffalo Rapids project investigated by the Bureau with an allotment of $25,000 from the Public Works Administration. It encompasses 17,000 irrigable acres of bottom land along the Yellowstone River stretching from Fallon to Upper Seven Mile Creek near Glendive.

This area of eastern Montana has been subject to severe drought for a number of years. Agriculture of all types has suffered greatly, and the livestock industry in that area, dependent on the public ranges supplemented by some forage from cultivated areas for winter feed, has sustained severe losses.

Because of the imperative need in this area for relief work and water supply for rescue of the drought afflicted farmers, the plan for construction of the Glendive unit therefore varies from that ordinarily followed in building Federal reclamation projects, in that a part of the cost is credited to rescue and relief. This money, $829,000, will be expended for all types of labor. The construction will be done largely by force account using all available relief labor.

Construction features of the project include: Pumping plant of 250 cubic feet per second capacity, estimated to cost $400,000; 32 miles of main canal and structures, estimated to cost $376,000; laterals and structures, estimated to cost $204,000; priming and puddling of canals, operating equipment and initial operation, estimated to cost $100,000; drainage system, estimated to cost $255,000; and engineering, superintendence, and contingencies, estimated to cost $270,000. The total cost is $1,605,000, and construction will require about 2 years for completion.

The Bureau of Reclamation investigation indicated that the water supply obtained from the Yellowstone River is adequate, and that the cost of operating and maintaining the irrigation works on their completion, including the cost of power for pumping, will be approximately $3 per acre a year. The water users' organization will take over operation of the project at its own expense.

The lands to be served are in private ownership.

THE annual Cassia County Fair was held at Burley, Idaho (Minidoka project) August 30 to September 2. The display of livestock, especially horses, was one of the best ever seen at the fair. There was also an interesting exhibit of noxious weeds gathered from Minidoka and Cassia Counties. Altogether the fair was pronounced highly successful, with unusually heavy attendance.

Weed Control Slides Available for Loan

The importance of the noxious weed menace to land uses is one of the problems to which irrigation farmers are giving increasingly serious consideration. Clearing irrigation ditch banks of noxious weeds and establishing permanent plantings of desirable weed-competing grasses, eradicating noxious perennial weeds where they have spread over large areas, the place and use of chemicals for inaccessible areas, new farm tools for weed eradication work are timely subjects presented in interesting fashion in the slide series New Ideas in Irrigation Agriculture. The series consisting of 56 slides in color shows scenes and farm operations on irrigation projects in the Western States.

In addition to slides on weed control, New Ideas in Irrigation Agriculture presents practical methods for spreading water on an irrigated farm, improved irrigation practices to conserve soil and water, ways to put waste farm land to profitable use, and suggestions for planting windbreaks to protect soil and crops.

A printed lecture, which can be read as the slides are shown, explains each slide, outlining the principles involved and their practical application in farm operations.

New Ideas in Irrigation Agriculture is available without charge, except for the payment of express costs, to irrigation districts, schools, county agents or civic groups interested in improved practices in irrigation farming. Requests for fall or winter booking should state the length of time the slides are desired, the place where they will be shown, the dates on which they will be used, and, if possible, a second choice of dates in the event the first dates should be scheduled. All requests should be addressed to the Commissioner, Bureau of Reclamation, Washington, D. C.

HARVESTING of grain on the Minidoka project was completed at the close of August and much of it had been threshed. Many unusual yields were reported, including 55 to 60 bushels of wheat per acre, 95 to 100 bushels of barley and on 1 farm an average of 129 bushels of oats on 3 acres. One field of alsike clover produced 9½ bushels per acre. A farmer near Heyburn harvested 300 sacks of Bliss Triumph potatoes from 3 acres, or an average of 261 sacks from 7½ acres.

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Projects in Miniature

By Paul G. Van Sickle, Engineering Draftsman, Bureau of Reclamation, Denver, Colo.

MODELS are practical and educational. The recent construction of numerous models for demonstration and educational purposes bears out past experience that models are a worth-while investment. Some of the most vague mental conceptions become immediately clear when they are converted into proportional models. Models are receiving a growing recognition in business, and especially for use in meritorious undertakings of an engineering nature requiring proof as to their practicality. The promotion of the San Francisco bridge owes its success, in some part, to models constructed to scale. Architectural, hydraulic, city planning, parks, and many other types of models have an important part in constructive education.

Perhaps the most difficult thing for a man to acquire is the ability to visualize an undertaking involving an area of several miles. It is especially difficult in uneven country. If the same undertaking be constructed in miniature to scale, the problem becomes immediately clear. The average man does not get a complete idea from the best of plans, as he cannot visualize the advantages and disadvantages of the project, unless he has an unusual ability to "read" plans. It is difficult for the layman to judge direction of roads and streams from a contour map, but from a model he can see at a glance the purpose of the entire project.

PORTER J. PRESTON, SENIOR ENGINEER IN CHARGE OF COLORADO RIVER INVESTIGATIONS, RESPONSIBLE FOR THE IDEA, AS WELL AS THE SUCCESS, OF THE GRAND LAKE MODEL.

The Bureau of Reclamation has found models of value not only to outsiders but to its own engineers working on the plans of a project. On account of the success of models in the past, the Bureau may construct a model of the Central Valley project in California.

Although it is possible for opposition, due to misunderstanding, to arise regarding a project, this misunderstanding can be eliminated and opposition converted to approval when it is demonstrated with a model that is constructed to scale. In preliminary discussions, facts are easily substantiated by a scaled model.

COLORADO-BIG THOMPSON MODEL

The Colorado-Big Thompson project was found to be one of the most feasible of its kind from an engineering standpoint. Yet, because of opposition through misinformation it was necessary to convince the public and the Congress. That the success in doing this was largely due to the model demonstration is beyond dispute. This model is perhaps the best example of the good results they produce, as its use meant the difference between victory and defeat of the measure in Congress.

This Grand Lake model is a finished scale model used by the Bureau of Reclamation for the information of those interested in the Colorado-Big Thompson project. It has been useful in demonstrating that the scenic beauty of Grand Lake and the Rocky Mountain National Park would not be destroyed, and that the attraction of the area outside and near the park would be enhanced by the project. The model also has been useful in demonstrating, where maps would fail to make it clearly understood, the feasibility of diverting water from the western slope of the Continental Divide to the eastern slope.

The opposition to this project was, as Senator Alva B. Adams, of Colorado, stated, "honest, but based on misinformation." It was realized by Bureau of Reclamation engineers that if the project were found feasible, the opposition would have to be overcome by facts supported by extensive studies. In the spring of 1936, the idea of building a model of the Grand Lake area was conceived, due largely to the opposition to the project. Near Grand Lake was the area in which there seemed to be the greatest misunderstanding. It was said that the project would mar the natural beauty of Grand Lake and the Rocky Mountain National Park. The model was constructed to demonstrate the effect the project would

GRAND LAKE MODEL ON EXHIBITION AT CHAMBER OF COMMERCE, DENVER, COLO., JANUARY 15, 1937.

MODEL OF GRAND LAKE AND COLORADO RIVER AREA

EXPLANATION

1. **GRAND LAKE.** Elevation, 8,371 feet; area, 507 acres.
2. **SHADOW MOUNTAIN LAKE.** Elevation, 8,371 feet; area, 1,356 acres.
3. **GRANBY RESERVOIR.** Elevation, 8,275 feet; area, 6,870 acres; capacity, 482,000 acre-feet.
4. **CONTINENTAL DIVIDE TUNNEL ENTRANCE.** 13.1 miles in length; outlet in Wind River near Estes Park.
5. **GRAND LAKE.** Population, 160.
6. **GRANBY DAM.** Earth and rockfill; height, 220 feet.
7. **NORTH FORK DIVERSION DAM.** Automatic spillway to maintain Grand Lake and Shadow Mountain Lake at constant elevation.
8. Canal from pumping station to shadow Mountain Lake.
9. **PUMPING STATION.**
10. **ROCKY MOUNTAIN NATIONAL PARK.** *A.* South boundary; *B.* West boundary.
11. **ADAMS FALLS.**
12. **COLUMBINE LAKE.**
13. **NORTH INLET TO GRAND LAKE.**
14. **EAST INLET TO GRAND LAKE.**
15. **NORTH FORK COLORADO RIVER.**
16. **SOUTH FORK COLORADO RIVER OR ARAPAHOE CREEK.**
17. **COLORADO RIVER.**
18. **TRANSMISSION LINE.** From power-house no. 1 at Estes Park.
19. **PROPOSED SYSTEM OF HIGHWAYS.** To develop the scenic possibilities.
20. **CAMP OURAY.** Y. M. C. A. boys camp.
21. **MOUNT BRYANT.** Elevation, 11,000 feet.
22. **TABLE MOUNTAIN.** Elevation, 8,815 feet.
23. **MOUNT ACOMA.** Elevation, 10,500 feet.
24. **SHADOW MOUNTAIN.** Elevation, 10,100 feet.
25. **MOUNT ENENTAH.** Elevation, 10,737 feet.
26. **FRASER RIVER DIVERSION CANAL.**
27. **MEADOW AND STRAWBERRY CREEKS DIVERSION CANAL.**
28. **WILLOW CREEK DIVERSION CANAL.**
29. **ROARING FORK RIVER.**
30. **STILLWATER CREEK.**
31. **SODA CREEK.**
32. **COLUMBINE CREEK.**
33. **DIRECTION OF TUNNEL.**
34. **SCALE OF MILES.**

The Colorado-Big Thompson project will divert 300,000 acre-feet of water annually from the headwaters of the Colorado River to the Big Thompson, a tributary of the South Platte River, through a 13.1-mile tunnel mainly for the supplemental irrigation of 800,000 acres in northeastern Colorado. It will develop 135,000 horsepower of electrical power in four plants. Three reservoirs on the Eastern slope will provide storage for 256,000 acre-feet at elevations to serve old existing canals on the St. Vrain, Little and Big Thompson, and Poudre Rivers. Replacement storage is provided in a reservoir on the Blue River to protect the Western slope irrigation interests.

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have on the park and the Grand Lake area. The model demonstrated that, contrary to the existing belief, the beauty of this entire area would not be marred, but enhanced.

Perhaps the greatest value of the model is the knowledge that it was created to a proper scale by the accurate reproduction of the country from drawings, actual photographs, and an intimate knowledge of the subject. It was the desire to simplify seemingly difficult engineering problems so that they could be understood easily. The model has been of educational value in that it has made the approach to a difficult question concrete instead of abstract. Porter J. Preston, engineer in charge, pronounced the work a great success from an educational standpoint, and stated that much useful knowledge was gained by all interested, even by engineers working on the design of the project.

It is believed by many that the six copies of the Grand Lake model have more than any other one thing gained the support of the people, as well as the Congress. The model displayed in Denver has been on exhibit and demonstrated by Mr. Preston to 26 organizations, numbering about 20,000 persons in and near Denver. These organizations were impressed by the accurate representation in miniature of something in which they were vitally interested. In addition to the several hundreds of people who visited the office of the Bureau of Reclamation to view the model, there also has been great interest shown in the other five copies of the model exhibited at Grand Lake, Greeley, Fort Collins, the office of Congressman Fred Cummings at Washington, D. C., and the office of the Bureau of Reclamation at Washington, D. C.

A model generally is intended to be an accurate representation in miniature of some existing prototype. Such things as these need not be costly, but should be made accurately, for without accuracy a model has no value. Correctly made it is useful in demonstrating the nature of conditions more difficult to describe with maps. These facts have been proved by the support given the Grand Lake model and the Colorado-Big Thompson project itself.

While the principal object in building this model was to educate the public to an understanding of the project, it will continue to be used extensively during negotiations for the sale of water and during the progress of construction.

The model was made possible through the cooperation of the Northern Colorado Water Users' Association and the Bureau of Reclamation, under the direction of Porter J. Preston, senior engineer.

Retrogression Below Boulder Dam

By W. E. Corfitzen, Assistant Engineer, United States Bureau of Reclamation

WITH the closure of Boulder Dam in February 1935, and the impounding of the hitherto unrestricted flow of the Colorado River in Lake Mead, certain natural forces were thrown out of equilibrium. Generally speaking, the laws of nature are extremely rigid. If a man-made obstruction is encountered which cannot be surmounted, then nature will make such physical adjustments as may be necessary to conform with its unyielding laws.

Since the flow over the river bed below Boulder Dam is now controlled at the dam, studies are being made bimonthly of the changes which take place along the bed, as a result of nature's attempt to reestablish equilibrium.

Before the dam was closed, the discharges varied with the seasons from less than 3,000 to more than 200,000 cubic feet per second. The silt content was always high, an average of about 330 tons per minute being carried past a given point. Shifting sand bars caused local changes of the stream bed, but the general river bed slope remained relatively stable, being about 2.0 feet per mile. Of the total silt load 50 percent, or 165 tons per minute, was finer than 0.0025 inch in diameter (about the diameter of a human hair). This material could be moved with very low velocities. Consequently, most of it remained in suspension and, where diversions were made for irrigation, it was transported into the canals and on to the fields.

Lake Mead, which now impounds about 15,000,000 acre-feet of water, provides a giant settling basin of still water, where the silt load is dropped into a space purposely provided to receive it.

As this desilted water flows from the reservoir in a state that has often been referred to as "crystal clear", it is literally hungry for silt, and has the capacity to pick up and transport huge quantities of material, particularly the finer sizes. Consequently, retrogression, or removal of the sand and silt of the river bed, takes place.

Observations of the river bed have disclosed that the fine surface material is first removed, but as soon as it becomes scarce the larger particles deeper down are moved. This may be illustrated by the average diameters of particles in the 12 miles of river bed immediately below the dam, which in the 2 years since closure of the dam have increased from 0.0098 inch to 0.394 inch, showing how rapidly the bed material is coarsening. The coarsening process does not go on indefinitely, however, as eventually a particle size is reached which will not be moved by the discharges ordinarily released from the reservoir.

At a section 2 miles below the dam, the bed has been degraded to a maximum depth of 12.5 feet. The average degradation over the first 8 miles of the observation area, which now appears to be relatively stable, is 6.7 feet. The depth to which the bed has been eroded decreases farther downstream until a point is reached about 50 miles below the dam at which no change from the old bed can be discerned. The point at which retrogression apparently ceases would seem to be the point at which the river has picked up as much load as it can carry. This is not the case, as observations 237 miles farther downstream near the Imperial Dam site disclose that the river carries more than three times as much silt in suspension as it did when it left the end of the retrogression area, leading to the conclusion that the river picks up fine materials downstream, which were not available in the retrogression area.

The actual volume degraded from the bed in 25 months of operation until February 1937 was 12,000,000 cubic yards. This volume would cover 7,440 acres to a depth of 1 foot, or would fill 268,000 standard coal cars, making a train 1,520 miles long.

This phenomenon is apt to occur whenever the flow of a stream, heavily laden with silt, is checked by a dam, and the desilted water flowing from the reservoir is allowed to run over a bed of erodible material. Engineers should consider the possibility of such action when planning intake structures for irrigation projects below newly constructed dams, lest such works eventually be left higher than the stream from which water is drawn. Likewise, the problem is of major importance in locating the draft tubes of new power plants in order that they may function properly after the retrogression of the river bed has ceased.

In conclusion it may be stated that a new river grade is being established below Boulder Dam by the removal of a large volume of fine material from the old bed. As the cutting waters bring each additional mile to its new grade, a mile of river once famous for its silt content is replaced by a mile of clear water. Each mile so added, assures Parker Reservoir (about 100 miles below Boulder Dam) of longer life, and will aid materially in the development of such recreational attractions as fishing, bathing, and boating.

Hearing on Colorado-Big Thompson Project

Secretary Ickes has issued invitations to interested persons for a hearing to be held in his office in the Interior Department Building, at 10 a. m., November 1, on the subject of the Colorado-Big Thompson project.

In his invitation the Secretary stated that the purpose of the meeting is to hear proponents and protestants of the project state their reasons for their stand on the subject.

The Interior Department Appropriation Act carries $900,000 for commencement of construction of the project. Before construction can be undertaken the Secretary of the Interior must be satisfied that repayment of all costs of the project are assured by appropriate contracts with water conservancy districts, irrigation districts, or water users associations organized under the laws of Colorado. In addition to this requirement in the act, the Secretary is resorting to this hearing to satisfy his own mind that criticism advanced by protestants with respect to any possible damage that might result from this construction to the Rocky Mountain National Park is unwarranted and has been appropriately dealt with in the plan for construction described in Senate Document No. 80, Seventy-fifth Congress, under which plan construction will proceed when the necessary clearance is given by the Secretary of the Interior.

The presence of proponents of the bill will permit of the presentation of all facts in favor of the project in addition to the plan as proposed. It is felt by the Secretary of the Interior that an open discussion by these two groups of this matter will lay the foundation for a better understanding of what is involved in the construction of this project.

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Progress of Investigations of Projects

Blue River transmountain, Colorado.—Adjustments were made on the triangulation network controlling the main Continental Divide tunnel. Profiles were made for several power penstock locations and areas and capacities were determined for several reservoir sites. Topography has been taken for a power conduit line from the east portal of Continental Divide tunnel to a power plant at no. 1 site at the mouth of Fall River, and for a second conduit line from power plant no. 1 to Idaho Springs. Topography was also taken along a conduit line from Floyd Hill tunnel to Bear Creek.

Eastern slope, Colorado.—Land Classification of the area between the Arapahoe diversion and Kenwood Dam was completed on the Cherry Creek irrigation and flood control. The report covering this feature of the investigation is in preparation and the geological report has been completed. Geological reports of the Trinidad irrigation and flood control and the North Republican River have been completed.

Western slope, Colorado—(*a*) *Collbran project.*—Canal topography was completed from Plateau Creek to the Sunny Side area ending at Jerry Gulch. Detail topography was taken of the Vega (Meadow) Dam site on Plateau Creek.

(*b*) *La Plate project.*—Field data on the results of reservoir and irrigable area surveys were assembled and water supply studies initiated for inclusion in the report.

(*c*) *Paonia project.*—Additional detail topography was taken below the Fruit Growers Dam site. Detail topography of the Smith Fork Dam site was completed, test pits dug, and water tested. Detail topography was taken on the Cow Creek Dam and Hubbard Creek Dam and immediate vicinity at the Overland Reservoir. A report on the cost of reconstructing the Fruit Growers Dam near Austin was completed.

(*d*) *Silt project.*—A reservoir site was surveyed on Meadow Creek, and detail topography taken of the dam site. Reconnaissances were made on Meadow Creek below the dam site and of the area between the site and Deep Creek.

(*e*) *Troublesome project.*—Topography was completed on a canal line from East Troublesome Creek to the Main Troublesome. Topography was taken on the Main Troublesome for a crossing from the canal to the constructed Kurtz lateral.

(*f*) *West Divide project.*—A reservoir feeder canal location was made from the Haystack Dam site to East Willow Creek and East Willow Creek to West Divide Creek. Work was started on the preparation of a report.

(*g*) *Yampa project.*—The report on this investigation was completed.

Boise (*Boise-Weiser-Payette*), *Idaho.*—(*a*) *Stanley Basin transmountain diversion.*—Survey was begun to determine the possibility of diverting by tunnel the flow of Salmon River in the vicinity of Stanley to Baron Creek on the Payette watershed. Level lines were run on the Stanley side and triangulation extended across the Sawtooth Mountains to Baron Creek.

(*b*) *Scriver Creek power site.*—Levels were run on Scriver Creek, Crouch, Idaho, to complete a closure with the Coast and Geodetic Survey network at Crouch. Profile was secured of Scriver Creek above and below the site of the tunnel outlet from Smith's Ferry.

(*c*) *Garden Valley Dam site.*—Triangulation and level control work for detailed topography of Garden Valley Dam site no. 3 on the South Fork of Payette River was started.

(*d*) *Cascade Dam and Reservoir site.*—Survey of the Cascade Reservoir site was continued. Vertical and horizontal control was completed.

(*e*) *Land classification and irrigable area surveys.*—Maps were completed and areas determined for the land classification surveys in the Mountain Home area and for reconnaissance irrigable area survey of lands located in the Willow Creek, Little Willow Creek, and Squaw Creek basins tributary to the Payette River.

(*f*) *Water supply studies.*—Study was made of avilable discharge records to determine storage requirements in the Weiser Basin, and study was initiated to determine the storage requirements on the Payette River.

(*g*) *Geological studies.*—Report on the results of a geological reconnaissance of the dam sites under consideration in the Boise, Payette, and Weiser watershed was completed. Detail geologic mapping was performed at the Lower Garden Valley Dam and Cascade Dam sites.

Buffalo Rapids project, Montana.—Field surveys were continued on alternative pumping lifts and canal lines to serve the Glendive unit. Field surveys were completed and a cost estimate prepared for a pump canal with a 75-foot lift. Cost estimates were prepared for two alternative plans to utilize the pump canal with the 130-foot lift.

Gallatin Valley, Mont.—Work was continued on the preparation of preliminary designs and cost estimates and a layout drawing for an earth- and rock-fill type of dam at the Spanish Creek site on Gallatin River. Water supply studies were completed to determine the storable flow and utilization of the Spanish Creek site.

Conchas surveys, New Mexico.—The report on these investigations was completed.

Buford Trenton, N. Dak.—A contract was negotiated with the State water conservation commission for the execution of these investigations.

Altus project surveys, Oklahoma.—Surveys of the distribution system were extended to include the area south and east of Altus. Drilling is in progress within the water area of the Altus Reservoir on the Red River to determine foundation conditions at the alternative Lugert Dam site.

Canby project, Oregon.—An assembly of run-off and crop census data and a canvass of present farmers to determine the attitude toward irrigation was made.

Deschutes project, Oregon.—The report on the Plainview investigations was completed, also draft of report on the south unit project.

Grand Ronde, Oreg.—A third measurement of the ground-water level over the valley was made. The triangulation network for horizontal control was extended to cover the site for a diversion dam at the mouth of the Grande Ronde Canyon, and the taking of typography was started. Aerial mapping of the Grande Ronde Valley and adjacent mountain areas was completed. Field surveys were completed of the Catherine Creek Reservoir for a highway relocation.

Black Hills, S. Dak.—Reports of the Angostura and Rapid Valley projects were reviewed and water requirements for the Rapid Valley project revised. Preliminary designs and cost estimates for a dam at the Deerfield site were completed and report on the Deerfield project started.

Utah investigations.—(*a*) *Ouray and Blue Bench.*—Work was continued on water supply studies, and detailed topographic survey will be made of the Still Water dam site.

(*b*) *Dixie project.*—Preliminary design studies were made for the Bench Lake Reservoir development. Studies were made for two heights of dams corresponding to storage capacities of 32,000 and 40,000 acre-feet respectively.

Utah-Idaho-Wyoming investigations.—In connection with the Green River-Bear River surveys, studies were initiated to determine the surplus water available for diversion in the vicinity of Daniel. An inspection trip of the Green, Bear, and Blackfoot River Basins was made to determine the method and scope of investigations.

(Continued on p. 244)

Quackgrass

By L. W. Kephart, Senior Agronomist, Noxious Weed Investigations, Bureau of Plant Industry, Department of Agriculture

QUACKGRASS or witchgrass (*Agropyron repens* (L.) Veauv.) is a creeping perennial plant of very aggressive habit, widely known as a pernicious weed on moist, fertile soils in cool regions. A native of northern Europe and Asia, it appeared in New England early in Colonial times, and from there spread over the Continent, southward nearly to the Gulf of Mexico. The areas of principal infestation are north of the latitude of Washington, D. C., and San Francisco. Although methods of controlling quackgrass have recently improved, the plant still ranks as one of the most destructive weeds of cultivated soil in the United States and is listed among the "noxious" weeds in the weed laws of nearly all States.

Quackgrass belongs to the group known as the wheat grasses, from their close relationship and resemblance to common wheat. Several of the wheat grasses, notably crested wheatgrass, slender wheatgrass, and bluestem or western wheatgrass, are valuable forage plants in the West. Quackgrass is itself a good hay, pasture, and soil-building plant, but its troublesome qualities far outweigh its virtues.

Quackgrass can be distinguished from other grasses by the seed heads and by the rootstocks. The seed head resembles a slender head of wheat. The rootstocks, commonly miscalled "roots", are underground stems, white or yellowish in color, about ⅛-inch in diameter, and 6 to 18 inches in length. The rootstocks branch through the soil in all directions, forming tangled masses to a depth of 3 to 12 inches. When undisturbed for several years the rootstocks congregate in a thin mat just under the surface of the soil. In plowed ground the rootstocks are scattered to the depth of the plow sole. Broken pieces of rootstock take root readily and give rise to new plants at the joints. Seedlings of quackgrass produce rootstocks within 8 weeks and a dense sod in one growing season. The true roots of quackgrass are fibrous and harmless.

No grass in the United States except the related bluestem of the Western Plains has both seed heads and rootstocks of this type.

CONTROL BY TILLAGE

Quackgrass, like all plants, can be killed if it is not allowed to make any leaves. However, the rootstocks are stored with starches and other food materials and are able to send new leaves to the surface almost as fast as the old leaves can be removed. It thus requires great persistence to exhaust these rootstocks by constantly cutting off the leaves. Fifteen or twenty such cuttings in 1 year are often not enough. Cultivation of row crops such as corn and potatoes in the ordinary manner is almost useless as a means of controlling quackgrass. Such cultivation is, indeed, one of the best ways to propagate the weed because the cultivator carries pieces of rootstock down the rows where they take root and grow. Only by excessive hand hoeing and pulling can quackgrass be subdued in intertilled crops.

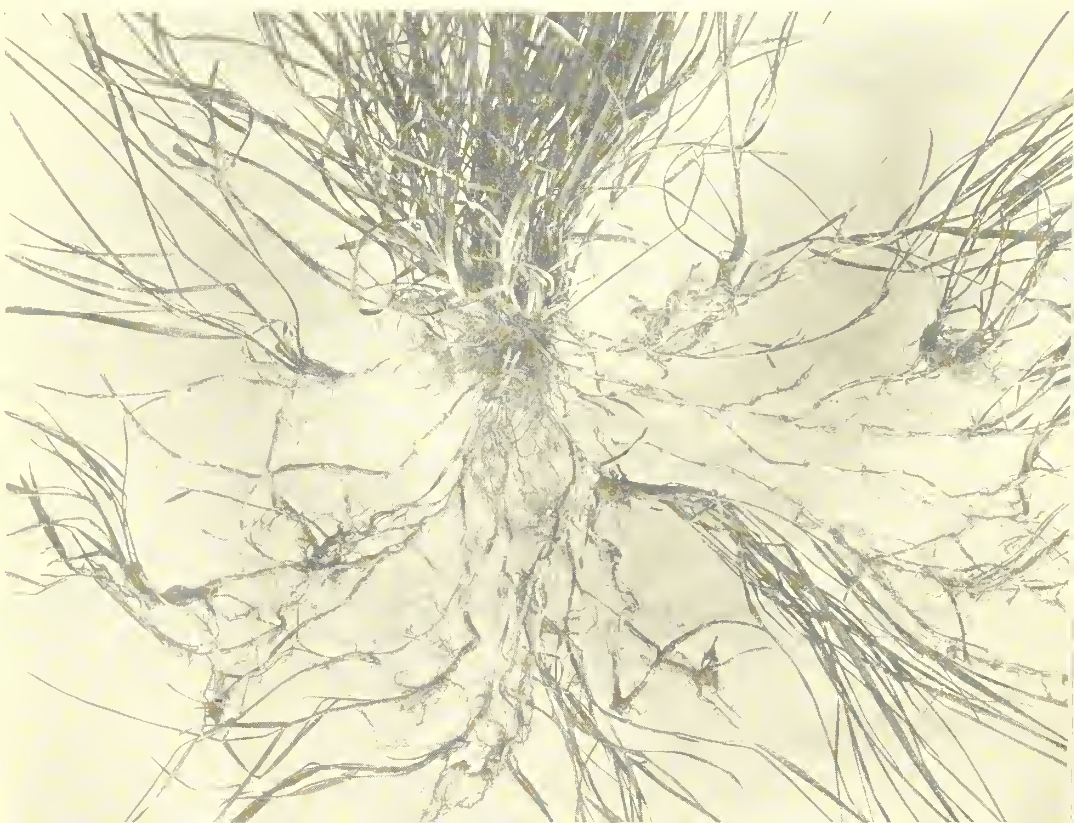
The method, recently introduced, of destroying perennial weeds with wide field cultivators equipped with duck-foot teeth is not very effective in eradicating quackgrass. Unless kept very sharp the duckfoot implements slide over or around the quackgrass instead of cutting it as they do Canada thistle and bindweed. Disc harrows used persistently are effective but require much power.

The best implement for destroying quackgrass is the spring-tooth harrow or field cultivator equipped with "quackgrass teeth." These teeth are sharp-pointed, penetrating, and springy. They are designed to dig up the rootstocks, shake them from the soil, and deposit them on the surface where, after drying, they may be raked into piles and burned.

In using the quackgrass harrow a common method is to commence about the middle of June, when the quackgrass is coming into bloom, and harrow the field at weekly or biweekly intervals thereafter until winter. Beginning with the harrow set at a shallow depth, the setting is increased a notch or two at each operation until running at full depth. The harrow is used alternately in different directions across the field, until by the end of the season the soil has been thoroughly worked and every particle or rootstock disturbed. Fewer harrowings are needed on sod ground than on land recently plowed, since the rootstocks on sod ground are all near the surface. The ground may be left rough over winter in order to allow the cold to destroy exposed rootstocks, or, if subject to erosion, may be planted with winter rye.

The next year the field is harrowed at intervals until time to plant a late crop of buckwheat, millet, soybeans, or some other crop that thoroughly shades the ground. On sandy soils the use of fertilizer on this crop is advantageous to promote a heavy growth. A good smother crop destroys any stray quackgrass that survived the harrowing.

Any method of control by tillage depends upon dry weather. The rootstocks are killed by exposure to the hot sun for 2 or 3 days, but in cloudy or rainy weather they lie on the surface uninjured



PART OF ONE YEAR'S GROWTH FROM A SINGLE SEED SHOWING STRONG DEVELOPMENT OF ROOTSTOCKS. SEED PLANTED MAY 1, 1917, PLANT HARVESTED OCTOBER 1917.—*Courtesy Bureau of Plant Industry, Department of Agriculture.*

and quickly take root. If wet weather interferes with tillage operations one must accept the situation philosophically and take up the task again when the weather becomes dry.

CONTROL BY SMOTHERING

Small areas of quackgrass can be killed by covering with some substance that totally excludes the light. Heavy tar paper is often used, laid so that the edges overlap about 6 inches and weighting them with ridges of soil to prevent them from blowing away. Two months under such a cover destroys almost any weed provided holes in the tar paper have not permitted leafy shoots to come through. Four feet of straw, two or three feet of heavy manure, boards, galvanized roofing, or any other opaque material is equally effective if carefully used.

Smothering is often more practicable than tillage for handling isolated patches of quackgrass, since a small patch in the middle of a large field is inconvenient to reach and difficult to care for with tillage implements.

CONTROL WITH CHEMICALS

Many chemical weed killers have been tried on quackgrass, including salts, arsenicals, oils, acids, alkalies, and oxidizing agents. The most successful is sodium chlorate.

Sodium chlorate is a salt, similar in appearance to common salt, but much more deadly to vegetation. It may be used either as a spray on the foliage (1½ to 2 pounds per gallon of water) or by spreading the dry substance on the surface of the soil. In either case 400 to 600 pounds of chemical are required per acre. Spraying requires special machinery and a convenient water supply, and involves considerable risk from fire (see note below). The dry chemical may be spread by hand or with a fertilizer distributor and carries little fire hazard. The dry method is therefore often preferred. A mixture of sodium chlorate and finely ground limestone, now on the market, is easier to spread than straight sodium chlorate though more expensive.

Spraying is best done in June and July or in autumn. It should not be attempted during very hot, dry weather. Dry treatments may be made at any time although late autumn applications are preferred. Repeat treatments are sometimes necessary to kill scattered plants that escaped the first treatment.

The use of sodium chlorate costs $35 to $60 an acre for the material, hence is not ordinarily practicable except for destroying small patches of weeds to prevent them from spreading or to kill weeds along fence rows, roadsides, and other inaccessible places.

In the amounts indicated above, sodium chlorate sterilizes the soil from 12 to 24 months, during which time crops cannot profitably be grown. After 25 or 30 inches of rain have fallen the chlorate disappears and the soil is as good as ever.

CAUTION

Sodium chlorate is harmless when in the original container. It becomes violently inflammable when mixed with organic materials. Extreme care must therefore be used that neither the solution nor the dry salt comes into contact with inflammable materials. This includes clothing, wooden floors, barrels, wagon beds, grain drills, hay, and all other combustible substances. Should such contact occur during spraying the exposed articles should be thoroughly washed before they have a chance to dry. If dry chlorate is spilled on a wooden floor it should be immediately and carefully removed. Failure to observe this precaution may result in serious injury to handlers of chlorate. Sodium chlorate is not poisonous in the ordinary sense of the word, although cattle should not be allowed to graze treated areas if this can be avoided.

KEEPING QUACKGRASS AWAY FROM THE FARM

Few weeds are as insidious as quack grass or more capable of obtaining a foothold unnoticed. In the early stages it looks like any other grass and is often present in discouraging quantities before the landowner realizes his predicament. It is more than usually desirable, therefore, to be on the lookout for quackgrass and to keep it from getting started.

One of the most common means by which quackgrass gets on to a farm is in seed or feed oats. The seeds are chaffy, resembling small oats, and since quackgrass is common in all oats-producing areas and ripens at the same time, oats from outside sources should be examined closely before use.

Commercial hay, especially timothy hay, is a frequent carrier of ripe quackgrass seeds. In former years quackgrass was a common constituent of all but the best grades of timothy hay. The adoption of Federal hay standards in market hay has reduced this danger but does not eliminate it, particularly in farm-to-farm sales.

Commercial grass and clover seeds, with the exception of bromegrass seed, do not ordinarily contain quackgrass seeds in any quantity.

ABOUT 25 large potato cellars, with a total capacity of approximately 150,000 sacks, are under construction on Klamath project farms or at shipping points.

Washington Conferees Designate 37 Weeds as Noxious

At a conference of county commissioners, county agents, experiment station and extension service specialists, and representatives of the Department of Agriculture, recently held at Pullman, Wash., 37 weeds of the State were designated as "noxious", according to United Press Dispatch appearing in the Yakima Daily Republic. The conference was called because of the recently-passed State law which designated the experiment stations and the extension service as those qualified to classify the weeds.

The article stated that it is possible more weeds may be added "to the 'noxious' list at a later date."

"According to the new law, county commissioners have the option of directing a compulsory campaign to control the noxious weeds of their county. Farmers must cooperate in all measures of control designated by the commissioners."

Weeds put definitely on the "noxious" list included: Quackgrass, dodder, fanweed, perennial sow thistle, poverty weed, bindweed or wild morning glory, Canadian thistle, Russian thistle, charlock, Jim Hill mustard, buckhorn plantain, darnell, sheep sorrel, wild oats, white top, Russian knapweed, leafy spurge, St. Johnswort, camelthorn, docks, Blue flowering lettuce, puncture vine, wild snapdragon, Klamath weed, broadleaved pepper grass, yellow spurge, wild chicory, burdock, cocklebur, spiny cocklebur, Iberian thistle, wild barley, tall larkspur, water hemlock, bull thistle, and poison ivy.

Investigations

(Continued from p. 242)

Colorado River Basin investigations—Colorado—(a) Disappointment Creek.—The classification of undeveloped lands in the Disappointment Creek basin was completed.

(*b*) *Josephine Basin project.*—Seventeen miles of stadia levels were projected to and over this area for use as vertical control in land classification studies.

(*c*) *San Miguel area, Norwood.*—Classification of undeveloped lands was completed, and stadia traverse for horizontal control was extended.

(*d*) *White River.*—In the vicinity of Buford and Meeker, 21,360 acres of irrigated lands along the upper portion of the White River were mapped and 69 miles of stadia traverse were projected for horizontal control.

Price and San Rafael Rivers, Utah.—Thirteen thousand six hundred acres of undeveloped lands lying adjacent to the present irrigated areas in the San Rafael River drainage were classified.

Bills previously listed in August Reclamation Era on which additional action has been taken

SENATE

No.	Title	Author	Date introduced	Action
S. 433	To provide for a survey of the Cabinet Gorge on the Clark Fork of the Columbia River.	Mr. Pope	Jan. 8, 1937	Reported from Senate Committee on Irrigation and Reclamation July 31, 1937.
S. 1344	Providing for relief in cases of desert-land applications or entries of lands within Verde River irrigation and power district, Arizona.	Mr. Ashurst	Feb. 3, 1937	Indefinitely postponed. Aug. 6, 1937.
S. 2092	To authorize the completion, maintenance, and operation of the Bonneville project for navigation and for other purposes.	Messrs. Bone, McNary, Schwellenbach and Steiwer.	Apr. 5, 1937	Indefinitely postponed. Senate passed H. R. 7642 using text of S. 2092. Aug. 6, 1937.
S. 2583	To provide for the acquisition of certain lands for and the addition thereof to the Tahoe National Forest, in the State of Nevada, and for other purposes.	Mr. McCarran	June 7, 1937	Reported from House Committee on Public Lands on Aug. 13, 1937.
S. J. Res. 57	To authorize the submission to Congress of a comprehensive national plan for the prevention and control of floods of all the major rivers of the United States, and for other purposes.	Mrs. Caraway	Jan. 30, 1937	Vetoed by President Aug. 13, 1937.

HOUSE

No.	Title	Author	Date introduced	Action
H. R. 2888	Granting a leave of absence to settlers of homestead lands during the year 1937.	Mr. Mott	Jan. 13, 1937	Vetoed by President Aug. 31, 1937.

Bills enacted into law since previous listings in August and September Reclamation Era

SENATE

No.	Title	Author	Date introduced	Action
S. 413	To create a commission and to extend further relief to water users on United States reclamation projects and on Indian irrigation projects.	Messrs. Borah and Hatch.	Jan. 6, 1937	Approved by President Aug. 21, 1937. Public 331.
S. 534	Granting the consent of Congress to the States of Montana and Wyoming to negotiate and enter into a compact or agreement for division of the waters of the Yellowstone River	Mr. Wheeler	Jan. 8, 1937	Approved by President Aug. 2, 1937. Public 237.
S. 607	To authorize improvement of navigation facilities on the Columbia River, and for other purposes.	Mr. McNary	Jan. 11, 1937	Approved by President Aug. 16, 1937. Public 293.
S. 1889	Authorizing the Secretary of the Interior to convey all right, title, and interest of the United States in certain lands to the State of New Mexico, and for other purposes.	Messrs. Hatch and Chavez.	Mar. 15, 1937	Approved by President Aug. 24, 1937. Public 344.
S. 1935	For relief of disbursing officers	Mr. Bailey	Mar. 19, 1937	Approved by President Aug. 12, 1937. Public 262.
S. 2086	To authorize appropriations for the construction of the Arch Hurley conservancy district in New Mexico.	Messrs. Hatch and Chavez.	Apr. 5, 1937	Approved by President Aug. 2, 1937. Public 241.
S. 2188	To amend sec. 3 of the act of June 18, 1934 (48 Stat. 984-988), relating to Indian lands in Arizona.	Mr. Hayden	Apr. 19, 1937	Approved by President Aug. 28, 1937. Public 395.
S. 2614	Authorizing the Secretary of the Interior to patent certain tracts of land to the State of New Mexico and Cordy Bramblet.	Messrs. Hatch and Chavez.	June 7, 1937	Approved by President Aug. 24, 1937. Public 345.
S. 2670	To provide that the United States shall aid the States in wildlife restoration projects and for other purposes.	Messrs. Pittman, Bailey, Clark, McNary, and White.	June 17, 1937	Approved by President Sept. 2, 1937. Public 415.
S. 2682	To authorize the Secretary of the Interior to issue patents to States under the provisions of sec. 8 of the act of June 28, 1934 (48 Stat. 1269), as amended by the act of June 26, 1936 (49 Stat. 1976), subject to prior leases issued under sec. 15 of the said act.	Mr. O'Mahoney	June 18, 1937	Approved by President Aug. 24, 1937. Public 346.
S. 2688	To provide for preliminary examinations and surveys for run-off and waterflow retardation and soil-erosion prevention on the watersheds of the Rio Grande and Pecos Rivers.	Mr. Chavez	June 21, 1937	Approved by President Aug. 28, 1937. Public 396.

HOUSE

No.	Title	Author	Date introduced	Action
H. R. 114	To provide for studies and plans for the development of a hydroelectric power project at Cabinet Gorge, on the Clark Fork of the Columbia River, and a reclamation project for the Rathdrum Prairie area, and for other purposes.	Mr. White	Jan. 5, 1937	Approved by President Aug. 14, 1937. Public 279.
H. R. 1420	For the relief of Dewey Jack Krauss, a minor	Mr. Thomason	do	Approved by President Aug. 4, 1937. Private 262.
H. R. 2512	To authorize the appropriation for the construction of small reservoirs under the Federal reclamation laws.	Mr. Greever	Jan. 11, 1937	Approved by President Aug. 26, 1937. Public 387.
H. R. 2562	For the relief of Mr. and Mrs. David Stoppel	Mr. Case	do	Approved by President July 22, 1937. Private 251.

Bills not previously listed

SENATE

No.	Title	Author	Date introduced	Action
S. 558	Amending acts fixing the rate of payment of irrigation construction costs on the Wapato Indian irrigation project, Yakima, Wash., and for other purposes.	Mr. Schwellenbach	Jan. 8, 1937	Passed by Senate Aug. 6, 1937. Reported from House Committee on Indian Affairs Aug. 11, 1937.
S. 2307	To provide for the conservation of the fishery resources of the Columbia River, establishment, operation and maintenance of one or more stations in Oregon, Washington, and Idaho, and for the conduct of necessary investigations, surveys, stream improvements, and stocking operations for these purposes.	Messrs. Steiwer and Schwellenbach.	Apr. 29, 1937	Passed by Senate Aug. 7, 1937. Referred to House Committee on Merchant Marine and Fisheries Aug. 9, 1937.

SENATE—Continued

No.	Title	Author	Date introduced	Action
S. 2638	To amend an Act entitled "An Act authorizing the construction of certain public works on rivers and harbors for flood control, and for other purposes", approved June 22, 1936.	Mr. Copeland	June 14, 1937	Passed by Senate Aug. 14, 1937. Referred to House Committee on Flood Control Aug. 17, 1937.
S. 2650	To authorize the completion, maintenance, and operation of the Fort Peck project for navigation, and for other purposes.	Mr. Wheeler	June 15, 1937	Passed by Senate Aug. 6, 1937. Reported from House Committee on Rivers and Harbors Aug. 11, 1937.
S. 2774	To authorize the Secretary of the Interior to relinquish in favor of the Blackfeet Tribe of the Blackfeet Indian Reservation, Mont., the interest in certain land acquired by the United States under the Federal Reclamation Laws.	do	July 15, 1937	Approved by President Aug. 28, 1937. Public 397.
S. 2820. (See also S. 2821; H. R. 5960; H. R. 7953; H. R. 7954.)	To provide for studies and plans for the development of a reclamation project on the Cimarron River in Cimarron County, Okla.	Mr. Thomas	July 22, 1937	Referred to Committee on Irrigation and Reclamation.
S. 2821. (See references under S. 2820; also H. R. 7937; H. R. 7938.)	To provide for studies and plans for the development of reclamation projects on the Cimarron River in Cimarron County, Okla.; the Washita River in Oklahoma, and the North Canadian River in Oklahoma.	do	do	Do.
S. 2863. (See also H. R. 7697.)	To promote conservation in the arid and semiarid areas of the United States by aiding in the development of facilities for water storage and utilization, and for other purposes.	Mr. Pope	July 28, 1937	Approved by President Aug. 28, 1937. Public 399.
S. 2875	To provide for the retirement of certain employees of the U. S. Government, for the payment of annuities, and for other purposes.	Mr. Bulow	July 30, 1937	Referred to Committee on Civil Service.
S. 2881. (See also S. 1744; H. R. 2267.)	To provide more adequate protection for workmen and the public in the construction of public buildings and public works of the United States, the District of Columbia, the Territories, and island possessions.	Mr. Sheppard	July 31, 1937	Referred to Committee on Education and Labor.
S. 2888. (See also H. R. 8026.)	To authorize the Secretary of the Interior to lease or sell certain lands of the Agua Caliente or Palm Springs Reservation, Calif., for public airport, and for other purposes.	Mr. Thomas	Aug. 13, 1937	Approved by the President Aug. 25, 1937. Public 375.
S. 2926. (See also H. R. 8064.)	To amend sec. 13 of the Classification Act of 1923 as amended.	Mr. Bulow	Aug. 7, 1937	Referred to Committee on Civil Service.
S. 2947	To create a national economic board and for other purposes	Mr. Berry	Aug. 11, 1937	Referred to Committee on Commerce.
S. 2961	Authorizing the free distribution of Government publications to certain schools and free libraries as a Federal aid to education.	Mr. Shipstead	Aug. 13, 1937	Referred to Committee on Education and Labor.
S. 2969. (See also S. 2970; H. R. 8202; H. R. 8276.)	To provide for reorganizing agencies of the Government, extending the classified civil service, establishing a General Auditing Office, and a Department of Welfare, and for other purposes.	Mr. Byrnes	Aug. 14, 1937	Referred to Select Committee on Government Organization.
S. 2970. (See also S. 2969; H. R. 8202; H. R. 8276.)	To provide for reorganizing agencies of the Government, extending the classified civil service, establishing a General Auditing Office, and a Department of Welfare, and for other purposes.	do	Aug. 16, 1937	Reported from Senate Select Committee on Government Organization Aug. 17, 1937.
S. 2980. (See also H. R. 7567.)	To authorize the Secretary of the Interior to permit the payment of the costs of repairs, resurfacing, improvement, and enlargement of the Arrowrock Dam in 20 annual installments, and for other purposes.	Mr. Pope	Aug. 18, 1937	Referred to Committee on Irrigation and Reclamation.
S. 3002	To authorize the Secretary of the Treasury to make settlement with the holders of certain unpaid notes and warrants of the Verde River irrigation and power district.	Messrs. Ashurst and Hayden.	Aug. 21, 1937	Referred to Committee on Claims.
S. J. Res. 186. (See also H. J. Res. 458; H. J. Res. 465; H. J. Res. 484.)	Providing for the participation of the United States in the continuing international exposition to be known as Pacific Mercado to be held in the city of Los Angeles, Calif., commencing in the year 1940, and in the year 1942, commemorating the landing of Cabrillo, and for other reasons.	Mr. McAdoo	July 27, 1937	Approved by the President Aug. 26, 1937. Pub. Res. 73.
S. Doc. 87	Report on the facilities for the passage of salmon at the Bonneville Dam, Oreg.		July 22, 1937	Referred to Committee on Commerce.
S. Doc. 95	Veto message on S. J. Res. 57—Comprehensive national plan for prevention and control of floods.		Aug. 13, 1937	Do.

HOUSE

No.	Title	Author	Date introduced	Action
H. R. 2737	To create a Federal Industrial Labor Council, to make agreements in commerce as herein defined irrevocable and enforceable, and for other purposes.	Mr. Smith of Washington.	Jan. 12, 1937	Referred to Committee on Labor.
H. R. 6295	An act to dispense with unnecessary renewals of oaths of office by civilian employees of the executive departments and independent establishments.	Mr. Cochran		Approved by the President Aug. 14, 1937. Public 284.
H. R. 6748	To establish a national land policy, and to provide homesteads free of debt for actual farm families.	Mr. Peterson of Georgia	Apr. 28, 1937	Reported from House Committee on the Public Lands Aug. 3, 1937.
H. R. 8245	Making appropriations to supply deficiencies in certain appropriations for the fiscal year ending June 30, 1937, and for prior fiscal years, to provide supplemental appropriations for the fiscal year ending June 30, 1938, and for other purposes.	Mr. Woodrum	Aug. 16, 1937	Approved by the President Aug. 25 1937. Public 354.
H. R. 8262	To provide for promotion on a seniority basis of employees within a department or independent establishment of the Government.	Mr. Luecke	Aug. 17, 1937	Referred to Committee on Civil Service.
H. R. 8276. (See also S. 2969; S. 2970).	To amend the Budget and Accounting Act of 1921, to establish the Office of Auditor General of the United States, and for other purposes.	Mr. Vinson of Kentucky	Aug. 18, 1937	Reported from House Select Committee on Government Organization Aug. 19, 1937.
H. R. 8277	To establish the Civil Service Administration, to extend the merit system, to extend the Classification Act of 1923, and for other purposes.	Mr. Mead	do	Reported from House Select Committee on Government Organization Aug. 18, 1937.
H. R. 8305	To provide for preliminary examinations and surveys for run-off and water-flow retardation and soil-erosion prevention on the watersheds of the Rio Grande and Pecos Rivers.	Mr. Dempsey	Aug. 20, 1937	Referred to Committee on Flood Control.
H. J. Res. 484. (See also H. J. Res. 458; H. J. Res. 465; S. J. Res. 186).	Providing for the participation of the United States in the continuing international exposition to be known as Pacific Mercado, to be held in the city of Los Angeles, Calif., commencing in the year 1940, and in the year 1942 commemorating the landing of Cabrillo, and for other reasons.	Mr. Ford of California	Aug. 9, 1937	Indefinitely postponed. S. J. Res. 186 passed by House on Aug. 20, 1937.

THE tomato canning season at the Grand Junction plant of Kuner-Empson Co. on the Grand Valley project started on August 16. The acreage contracted is large and the condition of the fields excellent. The demand for Kuner-Empson tomato juice packed from Grand Valley grown tomatoes has been increasing rapidly in recent years and a majority of the tomatoes will be used to this purpose.

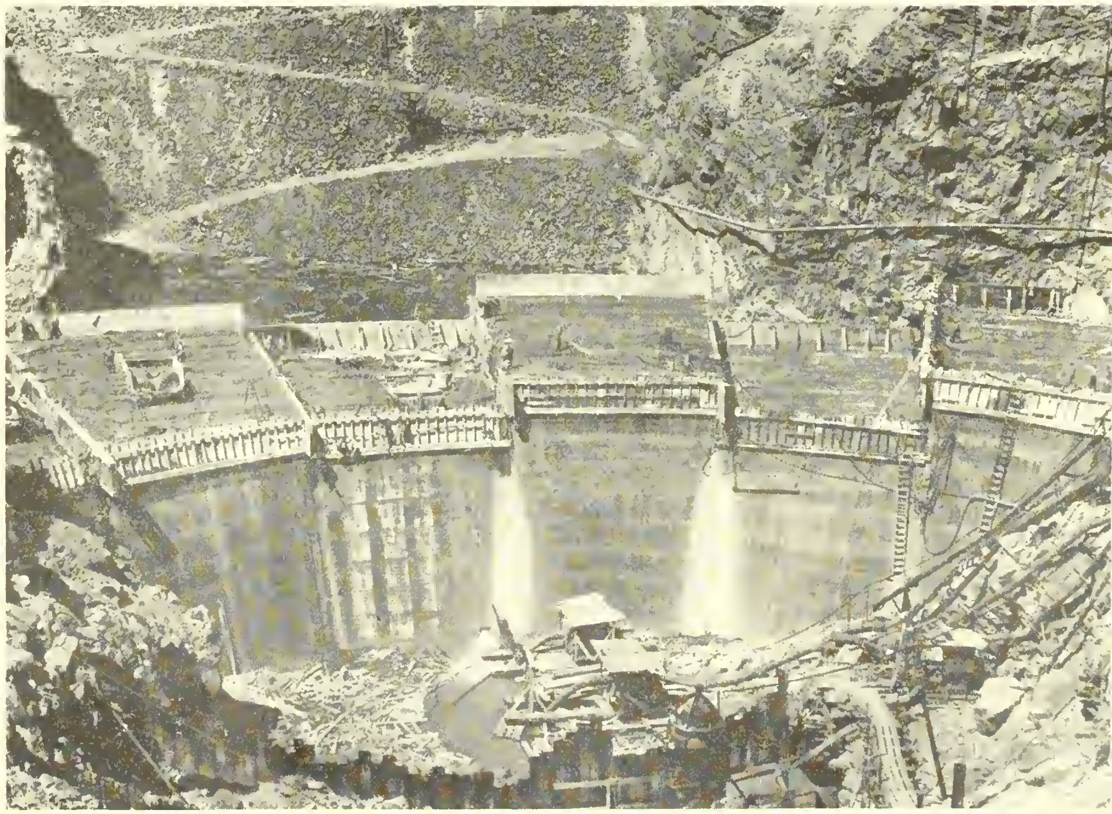
Notes for Contractors

Specification no.	Project	Bids opened	Work or material	Low bidders: Name	Low bidders: Address	Bid	Terms	Contract awarded
709	Central Valley, Calif.	Aug. 6	27 Duplex cottages at Government camp at Kennett Dam site.	John E. Branagh	Piedmont, Calif.	$90,000.00		Sept. 3
736	Boulder Canyon, Ariz.-Nev.	June 21	Control equipment for units N-5 and N-6.	Westinghouse El. and Mfg. Co.	East Pittsburgh, Pa.	[1] 48,152.00	F. o. b. Boulder City	Sept. 2
				NePage-McKenny Co.	Seattle, Wash.	[2] 18,223.00		Do.
742	Central Valley, Calif.	Aug. 7	Dormitories and residences at Government camp at Kennett Dam site.	Nels A. Anderson	Los Angeles, Calif.	128,800.00		Sept. 3
939-D	All-American Canal, Ariz.-Calif.	July 1	Insulated cable for Imperial Dam and desilting works.	Eagle Electric Supply Co.	Boston, Mass.	[1] 36,645.70	F. o. b. Potholes, Calif.	Sept. 2
						[3] 2,621.75	do	Do.
				Williamsburg Elec. Supply Corp.	Brooklyn, N. Y.	[2] 5,897.04	do	Do.
945-D	do	July 14	Pipe handrailing and light standards for Imperial Dam and desilting works.	California Steel Products Co.	San Francisco, Calif.	18,377.00		Sept. 10
950-D	Central Valley, Calif.	Aug. 10	Construction of concrete testing laboratory and combined garage and fire station at Government camp at Kennett Dam site.	Bay and Christofferson	San Bernardino, Calif.	15,165.00		Sept. 3
955-D	Upper Snake River, Idaho-Wyo., Truckee Storage, Calif.-Nev.	Aug. 20	32-inch and 42-inch internal differential needle valves for Grassy Lake and Boca outlet works.	The Smith Corp. d/b/a General Iron & Steel Works.	Portland, Oreg.	[4] 4,675.00 [5] 13,300.00		Sept. 8
961-D	Owyhee, Oreg.-Idaho.	Aug. 28	Earthwork, South Canal lateral S. C. 5.7 sta. 195 to end, and sublaterals Succor Creek division.	Geo. B. Henly Construction Co.	Ontario, Oreg.	8,380.00		Sept. 4
958-D	All-American Canal, Ariz.-Calif.	Aug. 25	Five motor-driven pumping units.	Hendrie & Bolthoff Mfg. & Supply Co.	Denver, Colo.	3,549.27	F. o. b. Pomona, Calif., discount $120.	Sept. 11
963-D	Owyhee, Oreg.-Idaho.	Sept. 2	Succor Creek pumping plant, penstock and discharge pipe; South Canal lateral 5.7-0.5-0.7.	Fife & Co.	Nyssa, Oreg.	8,223.10		Sept. 10
957-D	All-American Canal, Ariz.-Calif.	Aug. 24	Seven motor-driven, deep-well, pumping units.	F. H. Whiting Co.	Denver, Colo.	[1] 518.00	Discount 2 percent f. o. b. Lawrenceburg, Ind.	Sept. 13
				Palmer Supply Co.	Seattle, Wash.	[2] 1,857.17	Discount 2 percent f. o. b. Aurora, Ill.	Do.
948-D	Central Valley, Calif.	Aug. 9	Construction of office building at Kennett camp.	Nels A. Anderson	Los Angeles, Calif.	12,200.00		Sept. 18
964-D	do	Aug. 31	Construction of water tank at Kennett camp.	California Steel Products Co.	San Francisco, Calif.	[4] 3,874.00		Sept. 9
962-D	Owyhee, Oreg.-Idaho.	Sept. 1	Structures, South Canal lateral and sublaterals.	Henry L. Horn	Nyssa, Oreg.	22,551.00		Sept. 22
965-D	Kendrick, Wyo.	Sept. 3	Preparation and stock piling of concrete aggregates.	Mountain States Co.	Billings, Mont.	13,375.00		Do.

[1] Schedule 1. [2] Schedule 2. [3] Schedule 3. [4] Item 1. [5] Item 2.

Liability of Irrigation Districts Under the Social Security Act

In a letter to the Huntley Project Irrigation District, Mr. Victor H. Self, Acting Chief, Social Security Tax Unit, Treasury Department, Washington, on August 19, 1937, advised that under the provisions of the Social Security Act, services performed in the employ of a State, a political subdivision thereof, or an instrumentality of one or more States or political subdivisions, are excepted from "employment" as that term is defined in titles VIII or IX of the act defining the taxing provisions of the act. He held that a special assessment district lawfully created under the authority of a State is a political subdivision of the State within the meaning of sections 811 (b) (7) and 907 (c) (6) of the Social Security Act, and no tax liability is incurred by the district, or its employees, under the taxing provisions of titles VIII or IX of the act.



CLOSE-UP OF PARKER DAM FROM DOWNSTREAM.

Reclamation C. C. C. Work in Cooperation With the Bureau of Biological Survey

MINIDOKA PROJECT, IDAHO
CAMP BR-27

THE activities of the Biological Survey on the Minidoka project have been twofold in character. In cooperation with the C. C. C. the Survey has developed a wildlife refuge around Lake Walcott, and it has carried forward a program of rodent destruction and control over the entire project.

A bird reserve has been established for a number of years on both sides of Lake Walcott and some 25 miles of fence are being constructed, which will enclose approximately one-third of this area. These fences will keep out livestock and thus tend to preserve bird life. At occasional intervals, openings are left between the fences which will permit range cattle to get to the lake for water.

Minor roads which will serve for patrolling the fenced area have been built along the fences and will also be useful to stockmen who are grazing livestock in the vicinity.

Four earth-check dams have been built for impounding water on submarginal land and swampy areas along the lake edge, thus promoting the extension and improvement of feeding and nesting grounds for the area. Grasses which will furnish feed for the bird life have been planted around the reservoir and a small nursery for raising trees and shrubs to be planted in the future has been established.

The work against rodents probably has received the approval of the farmers more than any other activity undertaken. These rodents include ground squirrels, for which poison is used, and kangaroo rats and pocket gophers, which are both trapped and poisoned. It is believed these pests have been practically eliminated from canal banks, and the safety of the canals against breakage has been greatly increased. Good progress also has been made in exterminating these rodents from the farm lands of the project, both in Cassia and Minidoka Counties, and it is is not too much to expect that if the work is continued, these pests will no longer be a menace.

As an example of the efficiency of the work, the results accomplished on a canal bank about 200 yards long may be cited. This area was treated with poison and after a 30-minute interval 127 dead squirrels were counted, probably leaving an equal number of dead ones remaining in their holes.

Two campaigns of some 8 weeks each have been conducted against gophers, and an average of 500 of these rodents per week have been trapped.

During the winter months, the campaign is waged against rabbits. Thirty-two rabbit pens have been built around the rim of the project where the rabbits exist in the greatest number. These are strongly constructed of barbed wire to keep out stock, and poisoned hay is placed in them for the rabbits. They are visited about once a week by one of the field crew, who removes the dead rabbits and renews the supply of poisoned hay. Often it is necessary for this man to travel on skis and to haul the supply of hay and poison on a hand sled. It is estimated that about 45,000 of these pests have been destroyed in this way during the past two winters.

As an indication of the importance which the Biological Survey attaches to this project, it is stated that one of its agents will be stationed permanently at the Minidoka Dam to care for the various branches of its work that will be established there.

BOISE, OWYHEE, AND STANFIELD PROJECTS,
CAMPS BR-24, 26, 42, 43, 44

Five C. C. C. camps are operating under the direction of the Reclamation Bureau on the Boise, Owyhee, and Stanfield projects. An important feature of the work program at each of these camps is the control of harmful rodents and consists of poisoning and trapping pocket gophers, ground squirrels, rabbits, and other pests. Gophers cause damage by burrowing in canal banks and all species, if uncontrolled, make serious inroads on farm crops, particularly along the margin where irrigated areas join the open range. Rodent control has proven to be about the most popular of the C. C. C. activities, as far as the landowners are concerned. In organizing for the work, junior foremen accustomed to handling poison and trained in rodent control methods are recommended by the Biological Survey, which organization also conducts a central mixing station at Pocatello, Idaho, where poison baits are prepared and furnished at cost to the camps. The Reclamation camps furnish equipment and labor and carry on the work with the above assistance and with expert advice by district agents on the survey in laying out work programs.

The Biological Survey has carried on similar work in the past, but on account of insufficient funds it has been limited to demonstrational areas and the results have been educational only, as the rodents swarm into and reoccupy small areas as soon as work is discontinued. With the increased facilities and resources of the C. C. C. organization, comprehensive programs are carried out and large areas freed from pests.

The average activity for 1 year by a camp rodent-control crew, which included about 15 men and a junior foreman, and used 1 truck, follows:

Pocket gopher control

Poisoning:
- Time used—2,000 man-days.
- Supplies—600 ounces strychnine alkaloid and 7 tons sweet potatoes.
- Area treated—25,000 acres.

Trapping:
- Time used—400 man-days.
- Results—3,000 gophers trapped.

Ground squirrel control

- Time used—900 man-days.
- Supplies—12,000 pounds poisoned oats.
- Area treated—18,000 acres.

Feeding wild fowl (severe winter emergency)
- Time used—200 man-days.
- Supplies—4,500 pounds corn (furnished by interested outside organizations.)

MINIDOKA PROJECT—BIRD REFUGE DAM NO. 2 ON LAKE WALCOTT.

Another cooperative work project is the creation of a bird refuge at the Deer Flat storage reservoir. The reservoir is a feature of the Boise project constructed by the Reclamation Bureau and operated by the local Board of Control. The bird refuge project is sponsored by the Biological Survey and the refuge has been formally authorized by the President of the United States. No considerable funds have been made available for construction in connection with the refuge and the local agent of the Survey has been carrying on by borrowing men and equipment from the nearest Reclamation C. C. C. camp and by securing assignments of W. P. A. labor. The 10,000-acre reservoir has been fenced and construction begun on an administration building of stone and an observation tower of steel 100 feet high. Plans for the refuge will undoubtedly work out for the material benefit of migratory and local wild fowl and it will take its place in a planned system of such refuges.

BOISE PROJECT—LOCUST NURSERY PLANTED FOR THE BIOLOGICAL SURVEY BY ENROLLEES OF CAMP BR-24.

KLAMATH PROJECT, OREGON-CALIFORNIA, CAMP BR-20

Camp BR-20, located on the west rim of Tule Lake, was established in October 1935, for the purpose of reconstructing irrigation canals and structures in the Tule Lake unit of the Klamath project. At the end of one 6-month period the camp was temporarily abandoned, although the work program had by no means been completed.

The Biological Survey during this time had been assigned one camp—Clear Lake—which was wholly inadequate for the large program of improvement that had been planned. Furthermore, Camp Clear Lake was far distant from much of the work to be accomplished, while Camp Tulelake was near at hand.

During the summer of 1936 the superintendent of the Klamath project and the assistant refuge manager, Biological Survey, worked out a cooperative plan, whereby each Service would use a certain percentage of the available personnel of a company that might be stationed at Camp BR-20 (Tulelake), and received the approval of the director of the Civilian Conservation Corps.

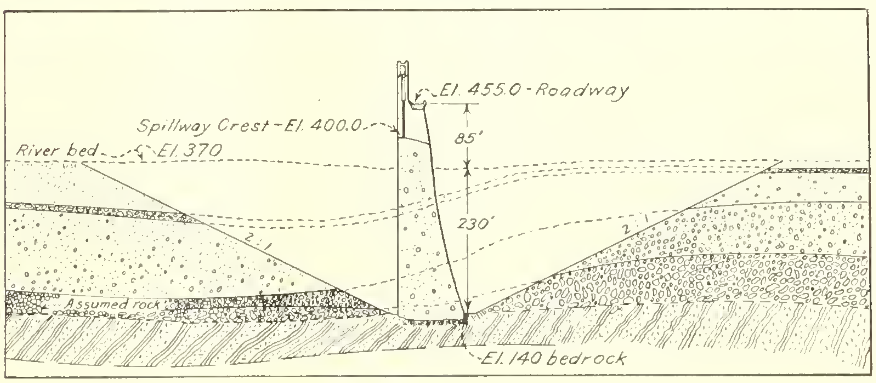
On October 14, 1936, company 3866 from the Eighth Corps area moved in. The boys, who were all from southern Texas, proved to have excellent ability, and the work accomplished has been quite satisfactory.

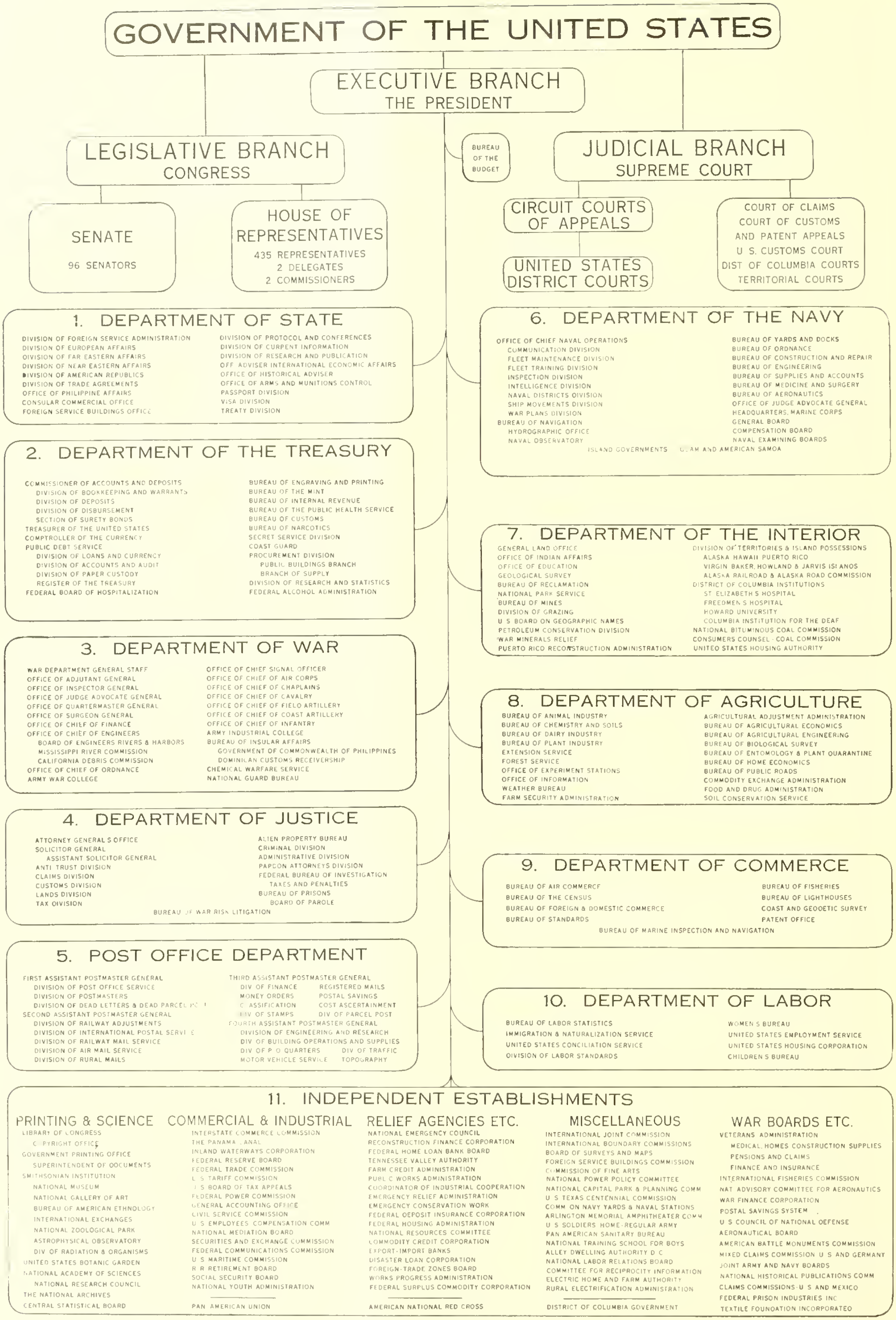
The camp, although under the supervision of the Bureau of Reclamation, has been on a 50–50 basis with the Bureau of Biological Survey as the use of available enrollees. Perfect cooperation has existed at all times between the two Services.

The total number of man-days employed on Biological Survey work aggregated 9,777 between October 1, 1936, and July 31, 1937. Some of the work accomplished comprised the building of 672 rods of fence; the laying of 808 feet of sewer and 2,045 feet of water pipe line; the construction of 69 rods of heavy stone wall and 309 linear feet of concrete walks around headquarters buildings; the building of 12.6 miles of good truck roads and 0.4 mile of foot trails; eradication of 11 acres of weeds; grading and landscaping of 5,494 square yards around headquarters buildings; and the planting and care of 5 acres of tree nurseries.

Altogether the cooperative plan of work carried out by Camp BR-20 has been eminently successful.

LOOKING DOWN ON PARKER DAM, PARKER DAM PROJECT, CALIF., FROM ARIZONA ABUTMENT.





COMPILED BY W I SWANTON SEPTEMBER 1937 DRAWN BY A M SMITH BUREAU OF RECLAMATION NO 26364

Reclamation Organization Activities and Project Visitors

The Kendrick project in Wyoming was honored by a visit of the Chief Executive in September, when President Roosevelt and his party stopped at Casper en route to the Pacific coast. The President addressed a group from the observation platform of his private car, and on October 2 visited the Columbia Basin project in Washington and made an inspection of the Grand Coulee Dam.

As this issue of the "Era" goes to press, Postmaster General James A. Farley is planning a trip during the month of October to the Pacific Northwest. On the Columbia Basin project he will view the progress made in the building of Grand Coulee Dam.

John C. Page, Commissioner of Reclamation, returned to Washington on September 20. While in the West he attended a meeting of the water resources committee in Salt Lake City, going from there to Boulder Dam. In Los Angeles he attended conferences on reclamation matters. At Sacramento he was interviewed over the NBC network concerning the Central Valley project, met with the California State authorities, and at the dam site named the dam at Kennett, Shasta Dam. At Boise Mr. Page was present and addressed the 2-day session of the Federal Irrigation Congress. At Denver he held conferences en route to the coast and on his return East.

Commissioner Page again left Washington for the West on September 29. On October 1 he attended the sixtieth annual meeting of the Nebraska Historical Society at Lincoln, Nebr., where he delivered an address on the subject "Challenge of the Truth."

Mr. Page was also present at the annual meeting in Casper, Wyo., of the National Reclamation Association October 12–13 and delivered an address on the subject "Progress and Problems of Federal Reclamation", the text of which appears elsewhere in this issue.

During the Commissioner's absence the office was in charge of Assistant Commissioner Roy B. Williams.

T. A. Walters, First Assistant Secretary of the Interior, visited the Upper Snake River project, Idaho, during the month of August.

Hon. James G. Scrugham and Hon. Emmet O'Neal, Representatives in Congress from Nevada and Kentucky, respectively, recently visited Imperial Dam, All-American Canal project; developed and undeveloped lands on the Yuma Mesa; and the irrigated areas of the valley and reservation divisions of the Yuma, All-American Canal, and Boulder Canyon projects. Hon. James M. Fitzpatrick, Representative in Congress from New York, accompanied Mr. Scrugham and Mr. O'Neal on an inspection trip over the Central Valley project. These Representatives compose the Interior Department Subcommittee of the House Appropriations Committee.

During the month of August, R. F. Walter, Chief Engineer, paid official visits to the Ogden River (Utah), Upper Snake River Storage (Idaho), Milk River (Mont.), and the Shoshone, Riverton, and Kendrick (Wyo.) projects.

J. Kennard Cheadle, chief counsel and assistant to the Commissioner, returned to Washington on September 23, after a 3-weeks' trip to the coast, where he contacted District Counsel B. E. Stoutemyer at Portland and made a visit to Grand Coulee Dam in Washington.

Henry W. Johnson, former chief clerk of the Ogden River project, has been appointed to the position of field representative with headquarters at Denver, Colo. Before reporting to the Denver office and assuming his new duties, Mr. Johnson paid a brief visit to the Washington office.

Prof. Frank Adams, of the University of California, called at the administrative office of the Bureau of Reclamation during his recent visit to Washington on matters relating to the National Resources Board.

F. A. Banks, construction engineer of the Columbia Basin project, has been designated by the Secretary of the Interior to represent him on an advisory board composed of representatives designated by the Secretary of War, the Federal Power Commission, and the Secretary of Agriculture to act in consultation with the administrator to be appointed to take charge of the sale and distribution of power from Bonneville.

L. H. Mitchell, field supervisor of district No. 4, arrived on the Frenchtown project on August 6, and assumed charge of its operation and maintenance. Under his supervision, head ditches have been located on a number of farms, and lands to be excluded from the district have been surveyed and those found unfit for irrigation have been excluded.

Gilbert H. Hogue, engineer in charge of canal location on the Friant division of the Central Valley project, has completed 35 years of continuous service with the Bureau of Reclamation. Mr. Hogue began work on the Boise project investigations on September 8, 1902. The work was directed by D. W. Ross under a cooperative agreement with the State of Idaho. Surveys, construction, and operations of the Boise and Minidoka projects have been the activities of Mr. Hogue covering several years. Other work was on the flathead project, Montana, and the Owyhee and Vale projects in Oregon. Transfer was made from the Upper Snake River investigation to the Central Valley project in November 1935.

Walter Sanford, a former employee of the Orland project and now an inspector on the Boulder Canyon project, called at the Orland office the latter part of August.

Allen Johannesen, chief of field party, Owyhee project, Boise, Idaho, died at Chicago, Ill., on July 26, 1937.

The following appointments have been authorized by the Secretary of the Interior:

Washington office:
- Mrs. Aloyse M. Cameron, senior typist.
- Miss Gladys D. Pinching, senior stenographer, vice Emma M. Rusnack, resigned.

Denver office:
- Tracey W. Cahow, assistant engineering draftsman.

Shoshone:
- Francis T. Hayden, engineering draftsman, Heart Mountain division.

All-American Canal:
- Arthur Cramer, inspector.

The following transfers have been authorized by the Secretary of the Interior:

To Denver:
- Robert F. Herdman to engineer from resident engineer, Bartlett Dam Site.

To Parker Dam:
- Walter M. Enger, junior engineer, from Denver.

To Columbia Basin:
- William W. Johnston, reclamation economist, from Denver.
- Alvin J. Smithies, inspector, from Frenchtown.

To Central Valley:
- John M. Cooney, chief of field party, from Boulder Canyon.
- Wendell M. Bell, junior engineering draftsman, from Denver.
- Charles C. Darden, senior clerk, from Boulder Canyon.

To Rio Grande (Caballo Dam):

Gilbert Waddell, inspector, from Alamogorda Dam, Fort Sumner, N. Mex.

To Shoshone (Heart Mountain division):

Herman F. Bahmeier, engineer, from Upper Snake River.

To Milk River (Fresno Dam):

Hyrum J. Woodward, junior engineer, from Frenchtown.

To Colorado River, Tex.:

Benjamin E. McCown, associate engineer, from Denver.

To Kendrick (Seminoe Dam):

Howard E. Robbins, engineer, from Salt River.

To Buffalo Rapids:

Paul A. Jones, construction engineer, from resident engineer, Gila.

To Upper Snake River:

Marion W. Archibald, junior engineer, from Alamogordo Dam, Carlsbad.

To Salt River:

Mrs. Gertrude D. Dieu, assistant clerk, from junior clerk, Ogden River.

William C. Boundy, inspector in the field service with headquarters at Eddystone, Pa., has been transferred to Milwaukee, Wis.

The following resignations have been accepted by the Secretary of the Interior:

Van O. Eastland, inspector, Boulder Canyon.

Mrs. Verona S. Lachenmyer, assistant clerk, Orland, to reside at Willows, Calif.

John Lewis Pulsipher, Jr., guide, Boulder City, to accept a better position.

Francis S. Cleamer, junior engineer, Columbia Basin, to accept a more remunerative position.

Earl D. Rainville, assistant engineer, Denver, to accept a professorship on the staff of the University of Michigan.

Louis M. Winkelhaus, assistant engineer, Denver, to accept employment in Nebraska.

Miss Elsie M. Raymond, junior clerk, Central Valley, to reside in Fresno, Calif.

Charles D. Flamm, senior clerk, Gila project, to accept private employment.

Robert J. Flowers, messenger, Columbia Basin project.

Frank Freeman, assistant engineer, Denver, to engage in private business.

Charles W. Pickett, assistant engineer, Moon Lake project, to go to Dubois, Wyo.

Arthur L. Sherley, model maker, Denver.

Reclamation Group meets in Bismarck to study Land Use

Reclamation and conservation developments in western North Dakota were analyzed at the annual conference of the Western North Dakota Reclamation and Conservation Association in Bismarck on September 8. Representing 20 Missouri slope counties, the organization was preparing an "aggressive promotional program" by which Federal agencies would be persuaded to lend maximum impetus to "Intelligent land use and conservation practices."

Out of potentially irrigable land of approximately 340,000 acres, of which 140,000 lie outside of the Missouri River Valley proper, only 25,000 are now being irrigated, the association learned.

F. P. Whitney, Dickinson, president of the association and a member of the State water commission, presided. W. W. McLaughlin, Chief of the Division of Irrigation, Bureau of Agricultural Engineering, Department of Agriculture, stressed the need for capitalizing upon experiences of recent drought years by construction of supplementary irrigation works. Mr. McLaughlin pointed out the entire surface water resources of North Dakota could be permanently captured and utilized by the expenditure of $35,259,000, exclusive of the proposed Missouri River diversion.

Public Land Open to Entry on Tule Lake Division, Klamath Project

Announcement has been made by the Secretary of the Interior that on October 25, 69 public land farm units, ranging in size from 53 to 86 acres, will be opened to homestead entry on the Tule Lake division of the Klamath Reclamation project, Oregon. For a period of 90 days, or until January 25, 1938, these units will be open to entry only by officers, soldiers, sailors, or marines who have served in the Army or Navy of the United States in any war, military occupation, or military expedition, and have been honorably separated or discharged therefrom or placed in the regular Army or Naval Reserve. Any units that may remain unentered after the 90-day period will be available to other duly qualified citizens of the United States.

Copies of the public notice, farm application blank, plat, and descriptive matter may be obtained by addressing the Commissioner, Bureau of Reclamation, Washington, D. C., or the superintendent, Bureau of Reclamation, Klamath Falls, Oreg.

THE Southern Pacific Railway Co. has acquired 22 acres adjacent to its property in Tulelake, Calif., and plans are being made to extend its terminal facilities at this station. The land was purchased at a price of $11,000.

F. W. Hanna, consulting engineer, visited the Washington office late in September. Mr. Hanna some years ago was in charge of the technical (now engineering) division of the Bureau's Washington office, later serving the Bureau successively as designing, project, supervising, and consulting engineer, and more recently was connected with the Canada Land & Irrigation Co. as general manager, and with the East Bay Municipal Utility District, Oakland, Calif., as chief engineer and general manager.

Federal Reclamation

(Continued from p. 231)

insure the settler, the home seeker, against exploitation by the land shark. In 1926, under authorization by the Congress, the Interior Department inaugurated a policy of forcing and supervising the sales of excess lands in private holdings on new projects. By regulations and by Government appraisals of the unimproved lands, we have prevented gouging of the settler, and we plan to continue to do so. This year the Congress passed the so-called antispeculation bill applying to the lands of the Columbia Basin project. Under its terms, the State of Washington must ratify the act, the lands must be impartially appraised by the Government and landowners must agree to sell their excess lands in accordance with the appraisals or suffer penalties before construction can proceed beyond completion of Grand Coulee Dam. This is good legislation.

Unless the new projects are settled by qualified settlers who have obtained their lands at fair prices, there can be little hope that the project will be able to become a strong project and little hope that the settlers will be able to meet their repayment charges. Unless the home seeker gets his chance to make a home for himself with reasonable expectation of paying out, what reason remains for Federal reclamation projects of this type?

We are determined that the settler shall have a square deal, and we are sure that the whole West is with us.

I have talked here of many things, of our work, our plans, our hopes, and our obligations.

May this work go forward. May it go forward because of what it has done for the desert States and through their development for America.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

THEODORE A. WALTERS, FIRST ASSISTANT SECRETARY, in charge of reclamation

John C. Page, Commissioner — **Roy B. Williams**, Assistant Commissioner

J. Kennard Cheadle, Chief Counsel and Assistant to Commissioner; Miss Mae A. Schnurr, Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr.; Wesley R. Nelson, Chief, Engineering Division; P. I. Taylor: Assistant Chief; A. R. Golzé, Supervising Engineer, C. C. C. Division; William F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk, Jesse W. Myer, Chief, Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner.

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman and H. W. Johnson, Field Representatives; L. S. Davis, Engineer, C. C. C. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz	Leo J. Foster	Constr. engr	J C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif
Burnt River	Unity, Oreg	Clyde H. Spencer	do		B. E Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E. W. Shepard	H. J. S Devries	El Paso, Tex
Alamogordo Dam	Fort Sumner, N Mex	Wilfred W. Baker	Constr. engr		do	Do.
Central Valley	Sacramento, Calif	W R. Young	do	E R. Mills	R. J Coffey	Los Angeles, Calif.
Colorado River	Austin, Tex	H. P Bunger	do	William F. Sha	H. J S. Devries	El Paso, Tex
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E Stoutemyer	Portland, Oreg.
Gila	Yuma, Ariz	Leo J. Foster	Constr. engr		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W J Chiesman	Superintendent	Emil T Ficenec	J R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev	Stanley R. Marean	Resident engr.[2]	George B. Snow	do	Do.
Kendrick	Casper, Wyo	H W. Bashore	do	C. M. Voyen	W. J. Burke	Billings, Mont.
Klamath	Klamath Falls, Oreg	B E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont	H. H Johnson	do	E. E. Chahot	W J Burke	Billings, Mont.
Fresno Dam	Havre, Mont	H. V. Hubbell	Constr. engr	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Superintendent	G. C Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J Westerhouse	Constr engr	Francis J Farrell	J R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	W J. Burke	Billings, Mont.
Ogden River	Salt Lake City, Utah	E. O. Larson	Engineer		J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R J. Newell	Constr. engr	Robert B. Smith	B E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif	E. A Moritz	do	George W. Lyle	R J. Coffey	Los Angeles, Calif
Pine River	Bayfield, Colo	Charles A Burns	do	John S. Martin	J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex	L. R Fiock	Superintendent	H. H. Berryhill	H. J. S Devries	El Paso, Tex.
Caballo Dam	Caballo, N Mex	S F. Crecelius	Constr. engr	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Bull Lake Dam	Riverton, Wyo	Arthur P. Smyth	Resident engr		do	Do
Salt River	Phoenix, Ariz	E. C. Koppen	Constr engr	Edgar A Peek	R J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J Burke	Billings, Mont.
Heart Mountain	Cody, Wyo	Walter F. Kemp	Constr. engr	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont	A. W. Walker	Superintendent		do	Do.
Truckee River Storage	Reno, Nev	Charles S. Hale	Constr engr.[2]	George B. Snow	J R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg	C. L. Tice	Reservoir supt		B E. Stoutemyer	Portland Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo	A A Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo	C B. Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage [3]	Ashton, Idaho	H. A Parker	do	Emmanuel V Hillius	B E Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C C. Ketchum	Superintendent		do	Do
Yakima	Yakima, Wash	J S Moore	do	Philo M Wheeler	do	Do.
Roza division	do	Charles E Crownover	Constr engr	Alex S Harker	do	Do
Yuma	Yuma, Ariz	R C. E Weber	Superintendent	Noble O. Anderson	R J Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting [3] Island Park and Grassy Lake Dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

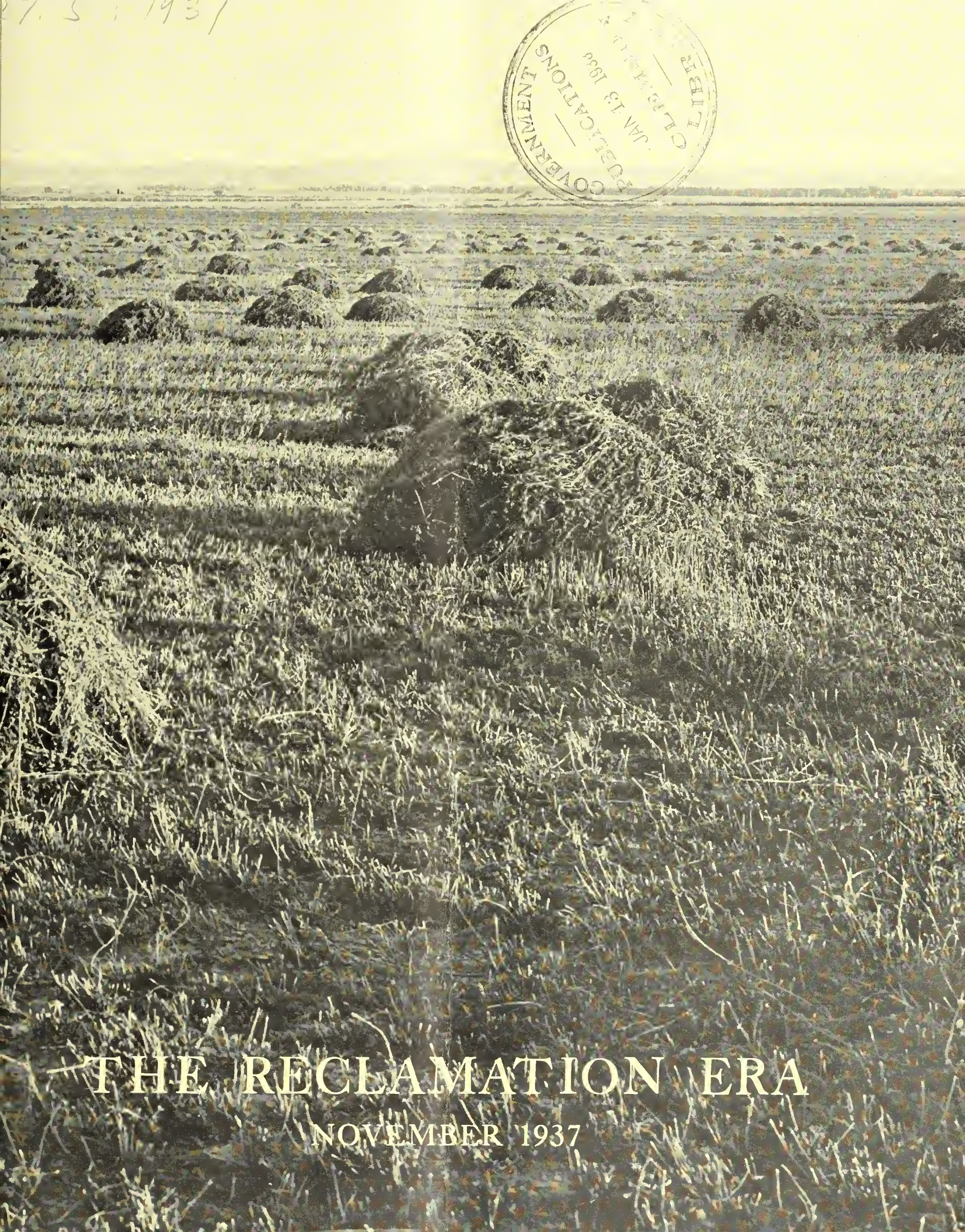
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division) [1]	Lower Powder River irrigation district	Baker, Oreg	A. J. Ritter	President	F. A Phillips	Keating
Bitter Root [4]	Bitter Root irrigation district	Hamilton Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise [1]	Board of Control	Boise, Idaho	Wm H Tuller	Project manager	F. J Hanagan	Boise.
Do [1]	Black Canyon irrigation district	Notus, Idaho	W H. Jordan	Superintendent	L M Watson	Caldwell
Grand Valley, Orchard Mesa [3]	Orchard Mesa irrigation district	Grand Jctn, Colo	C. W. Tharp	do	C. J McCormich	Grand Jctn.
Huntley [4]	Huntley irrigation district	Ballantine, Mont	E E. Lewis	Manager	H. S Elliott	Ballantine.
Hyrum [3]	South Cache W. U. A	Hyrum, Utah	B L. Mendenhall	Superintendent	Harry C Parker	Logan.
Klamath Langell Valley [1]	Langell Valley irrigation district	Bonanza, Oreg	Chas A Revell	Manager	Chas A Revell	Bonanza.
Klamath, Horsefly [1]	Horsefly irrigation district	do	Henry Schmor, Jr	President	Dorothy Eyers	Do
Lower Yellowstone [4]	Board of Control	Sidney, Mont	Axel Persson	Manager	Axel Persson	Sidney.
Milk River: Chinook division [4]	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity [1]	Minidoka irrigation district	Rupert, Idaho	Frank A Ballard	Manager	O. W. Paul	Rupert.
Pumping [1]	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding [1]	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands [3]	Truckee-Carson irrigation district	Fallon, Nev	W H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division [4]	Pathfinder irrigation district	Mitchell, Nebr	T W. Parry	do	Flora K Schroeder	Mitchell.
Fort Laramie division [4]	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do.[4]	Goshen irrigation district	Torrington, Wyo	Bert L. Adams	do	Mary E. Harrach	Torrington.
Northport division [4]	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J Thompson	Bridgeport.
Okanogan [1]	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.) [3]	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	do	D. D Harris	Layton.
Salt River [2]	Salt River Valley W. U. A	Phoenix, Ariz	H J Lawson	Superintendent	F. C Henshaw	Phoenix.
Shoshone: Garland division [4]	Shoshone irrigation district	Powell, Wyo	M. P. McLaughlin	Irri. superintendent	Geo. W. Atkins	Powell.
Frannie division [4]	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Superintendent	Lee N. Richards	Deaver.
Strawberry Valley [3]	Strawberry Water Users' Assn	Payson, Utah	S. W. Grotegut	Manager	E. G. Breeze	Payson.
Sun River: Fort Shaw division [4]	Fort Shaw irrigation district	Fort Shaw, Mont	E J Gregory	do	E J. Gregory	Fort Shaw.
Greenfields division [4]	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division [1]	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D Martin	Hermiston.
West division [1]	West Extension irrigation district	Irrigon, Oreg	A C. Houghton	do	A C. Houghton	Irrigon
Uncompahgre [3]	Uncompahgre Valley W U. A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose.
Yakima, Kittitas division [1]	Kittitas reclamation district	Ellensburg, Wash	V. W. Russell	Manager	G. L. Sterling	Ellensburg.

[1] B. E. Stoutemyer, district counsel, Portland, Oreg. [2] R. J Coffey, district counsel, Los Angeles, Calif. [3] J. R. Alexander, district counsel, Salt Lake City, Utah. [4] W. J. Burke, district counsel, Billings, Mont.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash	F. A. Banks	Construction engineer.
Colorado-Big Thompson	Denver, Colo	Mills E. Bunger	Engineer.
Gallatin Valley	Bozeman, Mont	R. R. Robertson	Do.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	Grand Junction, Colo	Frank C. Merriell	Do.
Black Hills	Denver, Colo	Denver office	Chief Engineer.
Eastern Slope (Colo.)	do	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do.
Conchas	Tucumcari, N. Mex	J. A. Keimig	Associate engineer.
Grande Ronde	La Grande, Oreg	C. C. Fisher	Engineer.

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget. SALLIE A. B. COE, *Editor.*



THE RECLAMATION ERA

NOVEMBER 1937

TO IRRIGATION FARMERS

YOUR occupation typifies the oldest form of CONSERVATION—extending back to prehistoric times.

It is the conservation or wise use of two NATURAL RESOURCES—water and highly mineralized arid land—neither of which would be productive without the other.

It required twenty-four years for our Government to embark on this national reclamation policy after it had been recommended to Congress by a member of the staff of the Department of the Interior.

It has built a new empire in a little more than that time.

Eastern farmers and manufacturers, not appreciating that your specialized agriculture does not generally compete with the old type of farming, for years have objected to the Federal venture in reclaiming the desert.

They give no credit to the new markets created and the new homes and families it supports.

The Department of the Interior has been responsible for the NATIONAL RECLAMATION PROGRAM from its inception, and it is sponsoring it actively today as in the past. Secretaries of the Interior repeatedly have considered it a growing asset to the Nation and have supported it wholeheartedly.

The attitude of people generally toward recl iming arid lands by the artificial storage of water, however, is more favorable because of the misfortunes of "Dust Bowl" families; yet there is still a strong element of public opinion opposed to it.

There are OTHER natural resources, however, that need to be conserved.

Timber, wildlife, grazing lands, minerals, and natural scenery are examples; and there is the further utilization of the scant supply of water that remains available for irrigation.

The PRESIDENT'S PLAN for reorganizing the machinery of government, which is now before Congress in special session, gives a prominent place to conservation. You should inform yourselves intelligently of the issues involved.

The President, among other changes to improve the transaction of Government business, recommends the establishment of a DEPARTMENT OF CONSERVATION in place of the Department of the Interior. This is the most important of his recommendations so far as you are concerned. It would give the President authority to group under a single head the agencies dealing with these various important assets of the people. This would obliterate the jealousies, extravagance, and conflicting policies now existing between competing agencies of government.

The Department of the Interior has been foremost in conservation policies for many years. Six of its seven bureaus and three of its principal divisions already are engaged in this work of conserving our natural resources.

YOU cannot expect to benefit from one aspect of conservation and ignore the others. Because of the rapid depletion of our natural resources, the policy of conservation is all-embracing and its various phases are indissolubly connected with each other. Wildlife is affected by reclamation, forests by grazing, mining by homesteading, and natural scenery by all of them. When you consider that these interests are sometimes conflicting and are supervised by various and sundry agencies of government, you can understand the importance of consolidation for the general good.

Underneath all of these conservation activities in the West lies the need for more WATER—the most precious mineral on earth.

You should support a movement that will tie together these conflicting elements in the WISE USE of natural resources for the benefit of all.

If further information is desired, write the Secretary of the Interior, Washington, D. C.

THE
RECLAMATION ERA
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The Challenge of the Drought

By John C. Page, Commissioner of Reclamation [1]

IN TIMES of drought with the heart-breaking lesson of disaster before us we turn more thoughtfully to consideration of our water problems. Memory is short, however, and a general break in the weather often intercedes before solutions are found and executed.

From the Rio Grande to the Missouri River, the whole Great Plains area is suffering from a severe and extended drought at this time. The people of the many States affected are acutely aware of the fact that they are confronted with a situation requiring drastic action and readjustments. The time to press forward toward some permanent and effective solution is now.

Fortunately, the whole Nation is awakening to the appalling magnitude and diversity of its problems connected with conservation and control of its waters. Floods in the Ohio Valley and dust storms arising in the West have given spectacular illustrations of the far-reaching effect of failure to take nature into consideration in our anxiety to build America. The conviction is growing that we must rebuild sanely and on a national front.

Conservation has powerful friends. Recently President Franklin Delano Roosevelt said in his Constitution Day address, "In our generation a new idea has come to dominate thought about government—the idea that the resources of the Nation can be made to produce a far higher standard of living for the masses if only government is intelligent and energetic in giving the right direction to economic life."

Secretary of Interior Harold L. Ickes also has been in the forefront of the conservation movement and to his watchfulness and unfailing energy much of the credit for the present advances is due.

These principles are reflected in a strong movement toward adoption of conservation as a major and continuing national policy, and to dignify it with representation through an executive department in the Cabinet of the President, as a positive declaration of our national intention in this regard.

Water is a major resource, in some localities the most important, and its conservation must have a high place in our new national program.

There is no section free from some problem connected with water, whether it be flood, navigation, domestic or irrigation supply, pollution, wildlife, or power. Some are faced with a complexity of them, each important. Too long expediency has governed our treatment of these problems. Each community has tried to solve, on a local and sometimes a temporary basis, water problems which overran county and State lines. The result has been, in many instances, aggravation in another nearby locality of the very condition for which a correction was sought.

Under the direction of the Water Resources Division of the National Resources Committee much progress has been made recently toward introduction of broader planning into these efforts.

INTELLIGENT USE OF WATER

Generally speaking, the West has taken a broader view. States which were carved out of territory which was frankly admitted to be arid or semiarid had no illusions concerning their water. From the beginning they realized that their growth and development in the end would be limited by the water within their boundaries and the intelligence with which they conserved and used it.

In the East the problem is not now and probably never will be one of parceling for wise use the water nature provides, but rather it is and it will continue to be one of controlling the water to make it a less damaging and a more serviceable tool.

But what of the area which lies between the humid East and the arid West? The Great Plains are neither humid nor arid continuously but, alternately, are either humid or arid as nature decrees. The one hundredth meridian which splits Nebraska in two, running down between Grand Island and North Platte, is the line which divides the humid from the arid.

If the weather were steadfast and each year the rain fell in the same amounts and on the same days, like water from a gigantic spigot controlled by a time clock, the peculiar problem of the Great Plains would not exist. Then a farmer would know in advance whether he were to receive enough rainfall for his crops and could make his plans accordingly. If the rainfall did not vary from year to year and seemingly run in cycles, either wet or dry, it is probable that little or no land west of the one hundredth meridian would have been plowed except that which could have been provided in advance with a reliable irrigation water supply.

But the rain is beyond human control and nature is inconstant. She sends her clouds where and when she pleases. We can say definitely about her methods that, over a long period of years, the average rainfall will not be different from that received over any other long period of years. It is safe also to say that where a flood has occurred another flood will come and where a drought has occurred another may be expected.

NORTH DAKOTA WATER SUPPLY

Reliable records show that the average annual rainfall, generally, west of the one hundredth meridian is below 20 inches a year, insufficient for safe farming, and, generally, east of the one hundredth meridian it is in excess of this amount. There have been decades in the past which belied this statement. There will be such years in the future, but the present drought in western Nebraska and in the other sections of the Great Plains is not without

[1] Address delivered Oct. 1, 1937, in Lincoln, Nebr., before the Nebraska State Historical Society

precedent. When it is broken, the wet years will be simply an interlude preceding another drought.

In 1889 Maj. John Wesley Powell, Director of the United States Geological Survey, stood before the North Dakota constitutional convention, earnestly pleading that title to the flowing waters of the State be retained for the people. He pointed to the curious geographical position of the State in relation to agriculture, saying the eastern part would have water for crops, the western part would soon learn to depend on irrigation, and that in the central part "they will have a series of years when they will have abundant crops; then for 2 or 3 years they will have less rainfall and there will be failure of crops and disaster will come on thousands of people who will become discouraged and will leave. Up and down the temperature of agriculture will rise and fall with the seasons in this manner and the only practical thing to do is to look this thing squarely in the face and remember that in middle Dakota agriculture will always be liable to meet with failure unless you provide against it. This is the history of all those who lived on the border between humid and arid lands. Years will come of abundance and years will come of disaster and, between the two, the people will be prosperous and unprosperous * * * There are waters rolling by you which are quite ample to redeem your land and you must save these waters. I say it from the standpoint of the history of all such land."

It was difficult to make the early settlers realize that the conditions described by Major Powell were insurmountable. There was a natural resentment against conceding that this border area should be classified with the arid lands to the West.

NEBRASKA'S WATER PROBLEM

I was interested in reviewing recently an article published early this century. It said in part: "The drought of 1890 made Nebraska one of the important irrigation States of the West. Canals had been built on the North Platte River near the Wyoming border several years earlier but the irrigation industry had won no general recognition. Thousands of farmers were persisting in the delusive hope of rainfall farming, and popular sentiment was distinctly opposed to those who sought to include Nebraska in the arid region."

That great drought had many of the same effects as this of the present time. A notable exception was that the population was less and there were fewer to suffer.

But it rained again and even more lands were broken, even more homes were established, and even more communities built, so that this, the next great drought, brought even greater disaster.

Will this same cycle of more rain and increasing enthusiasm, less rain and mounting human misery, be allowed to repeat itself again?

The answer will come from the people of this region, but the whole country is interested as never before. More sympathy and understanding, more encouragement and more help can be relied upon from other sources.

This problem should be approached with courage. The challenge of droughts must be met.

Nebraska is my native State. Since the "Cornhuskers" are my home folk, I would like to see you show the way. The people of this progressive State have given many proofs that they are unafraid of experimentation with new methods when they hold the promise of betterment. The adoption of a unicameral legislature by Nebraska has taught the country to look this way.

All cities have used the zoning method to protect valuable property and to assure that growth will follow an intelligent plan. This method of restricting unwise expansion and of maintaining the integrity of a well-laid plan for agriculture on a State-wide basis might prove effective if intelligently applied here.

Rural zoning in the Great Plains might give the firm control which must be exercised if at some future time another drought is not again to upset the economy and demoralize the populations of these States to even a greater extent.

Do not mistake me. I am not hinting that Nebraska or any other of the Great Plains States has reached the zenith of development and must now retrogress. This drought is a temporary set-back and, if proper readjustments and full utilization of the water resources are made, a much brighter and safer future lies ahead.

Each State would like to feel that all of its lands could be used for farmsteads. In the arid West this patently is impossible. The States out there have accepted this obvious fact with a determination to do the best they can with what they have. They have done very well. They have studied their water resources; planned diligently for their conservation; and generally managed to apply the limited water available to them so that it brings the greatest possible benefits. They have a security in their agriculture which is their compensation, and none of them has exhausted its possibilities.

A State which is one-third arid, one-third humid, and one-third in the twilight zone between the two can find no permanent security within itself if it is constantly expanding or painfully contracting in accordance with the whims of nature.

The Bureau of Reclamation now provides, and has provided for nearly 30 years, a regulated irrigation water supply from Pathfinder Reservoir for 250,000 acres along the North Platte River in western Nebraska. Here live in security nearly 25,000 people on more than 2,000 farms and in about a dozen towns. Despite the drought, these people have not been unprosperous. The value of their crops last year, during the worst of the drought, was about $9,000,000. The even tenor of their production has exerted a powerful stabilizing influence on a vast surrounding area, and it has been felt throughout the State of Nebraska. Omaha, one of the principal meat packing cities, has been markedly affected.

At this time there are under construction by groups of your own citizens several projects to provide a use of your waters for power and irrigation on the Platte and Loup Rivers. These were financed by funds from the Public Works Administration.

In the history of reclamation there has been almost no great project started to conserve and use our waters that was not attacked as "visionary", "impractical", or "foolish." There were many who said Boulder Dam could not be built and that, if it were, it would serve no useful purpose. But it was built and in record time, and it is doing all and more than was claimed for it.

Virtually from the time of Noah, when the ark was built as protection against the future amid jibes and wisecracks, such efforts have been the targets of Doubting Thomases. Now we hear some of the echoes in Nebraska.

While I will not undertake to pass judgment on any irrigation project outside my jurisdiction, I am convinced that projects which wisely use the water resources of this region will redound to the benefit of the people of the States and of the Nation. Nebraska cannot afford to let her waters waste.

Of the thousands of families, uprooted by the drought and now wandering west from the Great Plains, some came from Nebraska. If by proper planning now, another generation of homeless can be prevented from developing in the future, should not the necessary steps be taken at once?

In Nebraska, or over the larger part of the State, at the least, the most important use of water is for domestic and irrigation purposes. Each project should include, in addition, as many other purposes as can feasibly be worked into the picture. Power generation should not be overlooked in the engineering of these projects, for power, if it can be produced cheaply, will improve the standard of living and provide a revenue which in some instances will mean the difference between

an infeasible and a feasible irrigation or conservation dam.

Skeletons of old irrigation works dot the twilight zone of the Great Plains. Some of these have failed, among them two small projects undertaken by the Bureau of Reclamation in its early days, because the farmers who were to have been served forgot that drought recurs and refused to keep their water systems in operating condition during wet years. When they were needed, the canals could not be used. Since this drought set in back in 1929, these abandoned works, if they could have been used, generally would have saved many times their original costs.

There are undoubtedly in Nebraska underground water resources which safely could be tapped to supplement the natural rainfall in deficient years. The Bureau of Reclamation has never constructed a project which relied solely on pumping from wells. Properly regulated by State legislation or perhaps through the rural zoning method so as to prevent overdevelopment and eventual exhaustion of the so-called underground reservoirs, pumping for irrigation of comparatively small plots on the farms in the area most in need of a steadying influence might prove very effective. Your State engineer and the Geological Survey can be relied upon for reliable advice.

The Great Plains committee, on which I had the honor to serve, last year made a report to the President which contains much information which should be useful in formulation of a plan for State action. I will not review this report here for want of time and because it has been widely distributed.

Whatever is done must be initiated by the people affected and done with their cooperation. A candid understanding of the situation must precede permanent solution of the problem.

If the Great Plains are ready, if Nebraska is ready, honestly to face the facts and earnestly to work for a permanent remedy, then I believe the whole country will pitch in, like farmers at an old-fashioned husking bee, and help get the job done.

Glenn County Fair Resumed

The Glenn County Fair, which was an Orland institution prior to the depression, once more opened its doors September 29, with a record-breaking attendance the first day. This fair, which in size and quality of exhibits, would be a credit to communities many times the size of Orland, attracted exhibitors from hundreds of miles away. The premium list totaled $14,000 and project water users were successful in capturing a substantial portion of this amount.

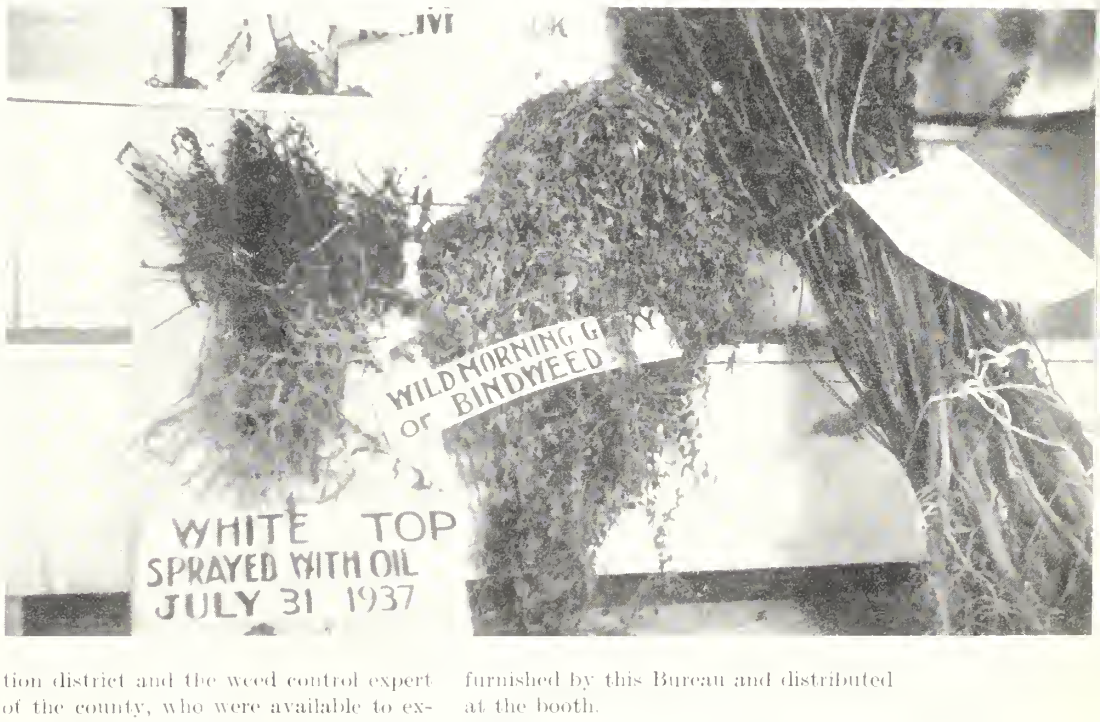
Day-Labor Versus Force-Account Methods

As an appeal to the small percentage of civil engineers of the country who fail to differentiate between day-labor and force-account methods of carrying on construction and perpetuating a deplorable and unnecessary confusion in terminology, Prof. Fred A. Barnes, of the Division of Railroad Engineering, School of Civil Engineering, Cornell University, has sent to the Era the following statement:

"Force-account is not 'a development of the day-labor system', but is distinctly a part of the lump-sum contract system. That is, the term arose on lump-sum contract work when part of the work, such as foundations, could not be designed readily in advance and therefore could not be included in the bid. These parts of the work were not 'extras', but were foreseen; and it was only natural to designate them force-account work since the engineer was required to keep account of the force of the contractor employed upon them. Thus the effect was really to apply a cost-plus method to parts of a lump-sum contract.

"This confusion in terminology can be eliminated very easily if all engineers will restrict the term force-account to this original meaning."

Noxious Weeds Displayed at Goshen County Fair



FOR approximately a year the Bureau has been giving special attention to the subject of noxious weeds. Spreading the gospel by articles and by word of mouth through its field representatives, it has been demonstrated this is an appreciated service by water users on Federal reclamation projects.

At the Goshen County Fair, September 8–10, inclusive, the Goshen irrigation district displayed a booth of noxious weeds. Views of the display are shown. The weeds were identified by name and included bindweed, white top, canada thistle, white ragweed, russian knapweed, water hemlock, and marihuana. Strawberry clover and brome grass were exhibited as useful plants which would grow anywhere the weeds would grow.

The booth attracted more attention than any other booth at the fair, as it was uncommon. Visitors from a neighboring county fair advised that they would make a similar exhibit during the following week's fair in their county. The booth was manned alternately by the superintendent of the Goshen irrigation district and the weed control expert of the county, who were available to explain the whole weed situation. Problems of visiting farmers were discussed and advice given as to control. Copies of the Reclamation Era, containing articles on noxious weed control, were furnished by this Bureau and distributed at the booth.

We are advised by the Goshen irrigation district that the exhibit will be enlarged in coming years to include some of the less known weeds which are considered a nuisance.

Work Starts on Contra Costa Canal Central Valley Project

FIRST construction of permanent works of the Central Valley project was started on October 14, 1937, near Oakley, Calif., on the initial 4-mile section of the Contra Costa Canal, important unit of the vast water conservation enterprise.

Official notice to proceed with the work was given to Haas, Doughty & Jones and Marshall & Stacy, San Francisco contractors, by the Bureau of Reclamation. The construction involves earthwork and structures for a broad tidewater section of the canal extending from the Rock Slough intake near Knightsen on the lower San Joaquin River, to the first pumping plant near Oakley.

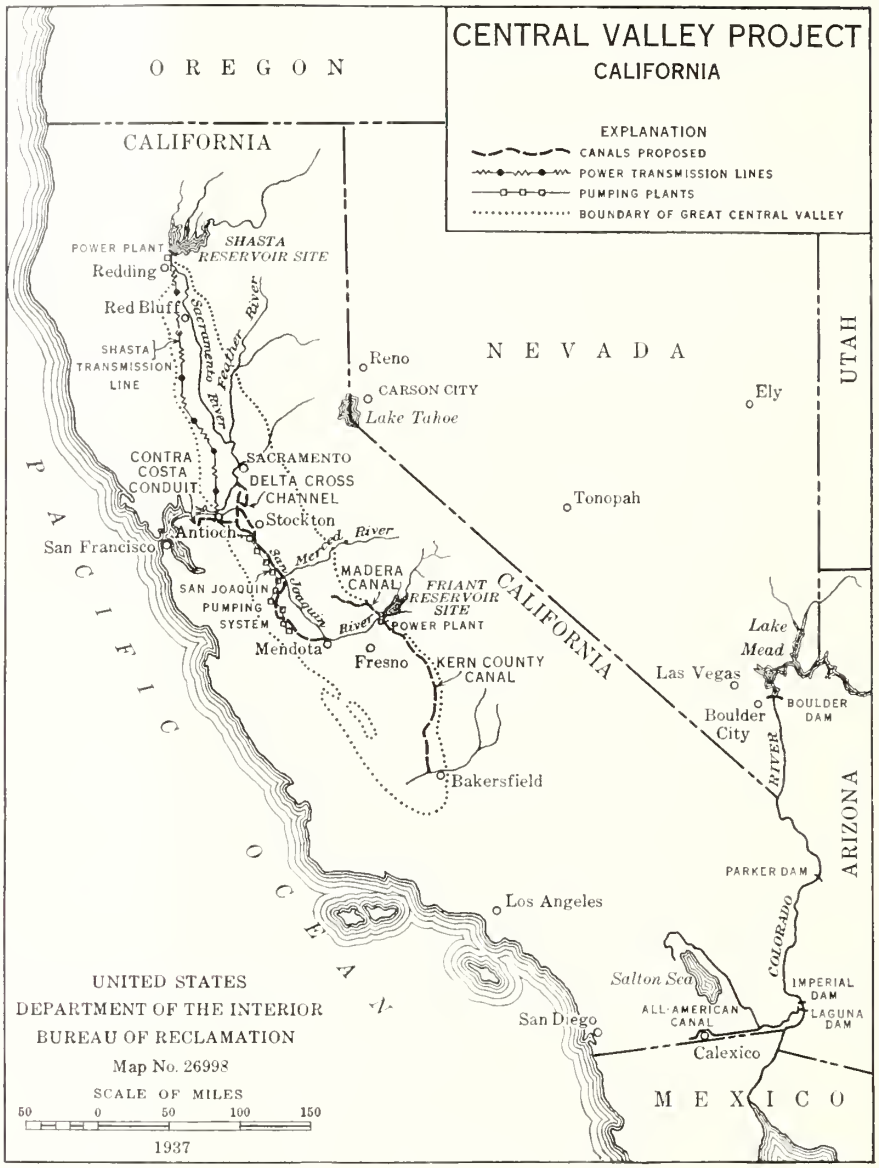
Awarding of the contract for $102,646, the lowest bid of 25 proposals received last March 1, was approved by Secretary of the Interior Harold L. Ickes on March 23. The delay in starting construction has been occasioned by difficulties encountered in acquiring the necessary rights-of-way.

A Federal court order to take possession of the lands in eminent domain was given the Bureau of Reclamation as a result of condemnation suits filed on 33 acres of the Emerson property, involving a mile of canal right-of-way, and 18 acres of the Luiz property, involving a half-mile of right-of-way. A cash bond was deposited with the court by the Government pending future determination by a jury of the question of compensation.

Walker R. Young, the Bureau construction engineer at Sacramento, said the acute need for water in many parts of the project area makes it incumbent upon all concerned—both public and private interests—to cooperate to the fullest degree in right-of-way and water-right matters, so that large-scale construction will not be held up by involved court procedure.

Central Valley project field work until now has been confined to extensive surveys, dam-site explorations and camp building. Mr. Young said the first dirt would fly on actual construction in excavation for the Marsh Creek siphon, one of four similar structures at stream crossings in the initial section of the Contra Costa Canal. This ditch will be 24 feet wide at the bottom and approximately 100 feet wide between top of banks, involving the excavation of 640,000 cubic yards of earth. The contract also includes the erection of six farm bridges across the canal.

Meanwhile, Chief Engineer R. F. Walter of the Bureau of Reclamation announced in Denver that advertisements soon will be issued for construction of the next 8 miles of the canal, from the end of the present contract to the south boundary of the Los Medanos oil storage reservoir property near Pittsburg.



Ultimately the Contra Costa Canal will extend from Rock Slough westerly about 40 miles to a small reservoir above Martinez. It will deliver fresh water to an important industrial district along the south shore of Suisun Bay, provide an irrigation supply for an adjacent upland area of orchards and field crops, and afford a domestic water supply for five municipalities. The canal is made necessary as a result of salt water encroachment from San Francisco Bay.

Other features of the $170,000,000 Central Valley project, designed to protect several hundred thousand acres of California farm lands from the palsy of drought and salinity, will include the huge Shasta Dam and power plant on the upper Sacramento River Friant Dam on the San Joaquin River, the Friant-Kern and Madera canals in the upper San Joaquin Valley, and the San Joaquin pumping system in the lower San Joaquin Valley.

IN *Salt River Valley Water Users Association* v. *Salt River Project Agricultural Improvement and Power District*, 70 Pac. (2d) 452, decided July 6, 1937, the Supreme Court of Arizona refused to rule in declaratory judgment proceedings whether the bonds of the district were or were not tax-exempt, holding that this question was not properly involved in the issues, and that the State would be a necessary party when this matter is determined.

Balancing Our Resources' Budget[1]

By Hon. Harold L. Ickes, Secretary of the Interior

TODAY the United States is striving for a balanced budget. This budget, which is our immediate and important concern, is a budget of daily income and outgo. It is one of dollars and cents; it consists of rows of bookkeepers' figures.

Important as this is, we have still ahead of us a greater task which we have barely commenced. This consists of balancing the budget of our national assets—our natural resources, which we have been squandering since they have been given to us in trust. When is America going to undertake that balancing of resources, where to date it has been all outgo and no income to speak of? When are we going to constitute an agency of government which is willing and able to undertake this task and can be responsible for the result?

CONCENTRATING CONSERVATION

Why is it that this country can so easily run a fever over the cash budget and cannot realize that we have squandered and are squandering our priceless heritage of resources which we could never replace? Why is it that we become hysterical over wasting crumbs on the dining-room table and allow loaves to be purloined from the pantry shelf?

The reason is that there never has been and there is not today in the United States any one agency of Government responsible for conserving our natural resources. There is no central agency of government charged with this task.

This condition should not endure. Fortunately, President Roosevelt, while engaged in balancing the cash budget, is looking ahead. He is concerned about the national wealth that is locked up in our natural resources. He envisions a Government which guards those resources which are the storehouse and depository of the Nation's future welfare.

When the President laid the cornerstone of the new Interior Department Building in Washington in April 1936, he enunciated a policy of conservation of our natural resources that, if the people get behind it, is destined to guarantee the development and a prudent use of our remaining resources for the benefit of all Americans. He declared that he was dedicated to the cause of conservation.

As a lifelong believer in the principles of conservation and of the prudent use of our topsoil, forests, water supplies and minerals, I was greatly heartened by what the President said. I was encouraged not only because the President voiced his confidence in the Department of the Interior as the conservation arm of the Government on that occasion but because here was a President of the United States declaring that the vast national domain and the other natural resources of the country belonged to all of the people and were not the property of any class regardless of the privileged status that it had had in the past.

It is, therefore, with a sense of satisfaction and pride that I am able to say to the people of America tonight that the Administration now in Washington is undertaking a conservation program which is predicated upon the sound philosophy that our resources are to be guarded and used for the greatest good of the greatest number of our citizens.

I need mention only Grand Coulee Dam and the Bonneville project on the Columbia River and the Fort Peck Dam at the headwaters of the Missouri River as steps in the greatest flood control, navigation and irrigation programs ever undertaken by any Government anywhere. Boulder Dam, which harnesses the Colorado River, has been completed and put into operation ahead of schedule, and completion of the significant Tennessee Valley development is proceeding rapidly.

INTERIOR LEADS IN CONSERVATION

The Bureau of Reclamation, in my own Department, is engaged in the largest reclamation and irrigation program in our history.

Under the Taylor Grazing Control Act, we have made progress far beyond our earlier expectations toward saving what remains of the public range with the result that stabilization of the livestock industry is in sight at last. This act, administered by the Department of the Interior, is one of the most important single conservation measures ever enacted by the Congress.

The interest of our people in the enlargement and development of our national park system has shown a tremendous growth during the past 5 years. Attesting this is the fact that during the past year more than 15,000,000 persons, or about one person in every eight of our population, visited our national parks and monuments.

The production and sale of hot oil in our largest field in east Texas has been virtually stopped as a result of cooperation between the Department of the Interior and the State of Texas and it is my observation that our people, including those in the oil industry, are rapidly coming to the conclusion that petroleum is an irreplaceable resource and should be conserved at all costs.

It is not by mere chance that it has remained for the Department of the Interior to take the lead in the present-day conservation movement. This Department does not consider conservation the mere hoarding of our resources. While Interior is fully alive to the imperative necessity of protecting and preserving all of our natural resources, it does not hold that conservation is incompatible with a continued growth of the country. Just the opposite is the fact. We believe that conservation will make for a greater enhancement of our country in the future than would a policy of continued exploitation. It will provide substitute fertile lands for the acres of the dust bowl which are the result of improvident farming. It will permit decentralization and the breaking up of our congested areas so that we may acquit ourselves of those areas which, because of overcrowding, breed sickness and crime.

The Department of the Interior holds that we must rephrase the philosophy of the past with respect to the handling of our natural resources. We must inculcate as a fundamental tenet of Americanism the belief that the proper exercise of our form of Government carries with it the obligation to use Nature's gifts prudently so that all the people may benefit—not only those of today but those of tomorrow and the day after. I think it is time that in our schools, both grammar and secondary, and in our colleges as well, we should begin to inculcate an understanding of the magnitude and the importance of the problem of proper husbandry of soil and water and minerals.

GRAND COULEE BENEFITS NATION-WIDE

Since we first discovered our resources, we have grown to be a mighty Nation and we must think in national terms. All of us are vitally concerned in what happens to any one of us. For example, in the far northwest in the State of Washington the Department of the Interior through the Bureau of Reclamation is harnessing the great Columbia River at Grand Coulee. When this project is completed, its economic and social repercussions will be felt throughout the length and breadth of the land. It will open 1,200,000 acres of rich agricultural land to settlement. This huge acreage is contained within an area perhaps twice that large, an area almost equal in size to the State of Connecticut and three

[1] Excerpts from address delivered on Star Radio Forum, Nov. 1, 1937.

times larger than Rhode Island. Development of this region on the east side of the Cascades will bring with it the creation and growth of small towns with their commerce and industries. These towns will attract nonfarmers—shopkeepers, artisans, and the like. Railroads and busses will be required to serve them. Telephone and telegraph lines will have to be extended. Population movements will occur. Schools and homes and churches will be built. The electric energy which will be developed at this project will be used for pumping water to the farms and the balance will make possible a vast and diversified industrial development.

Will not this fruitful growth in a place which now is waste land send its beneficial roots out to the people along the southern and eastern boundaries of the Nation? This country is so vast that to a stranger visiting it for the first time, a transcontinental ride on one of our streamlined trains gives him a feeling of endlessness. Seemingly for hours without end, he rides through fertile fields, along restful valleys nestling between high peaks. He sees a great variety of fruit and other products of the soil and a multiplicity of commerce and industry. To drop the Grand Coulee development into the great economic sea that is the Nation is like dropping a stone into a quiet pool causing eddies to surge on and on until every part of the pond has been brought to rippling life.

JOHN W. POWELL, A CONSERVATION PROPHET

It was back in post Civil War days that a new era in the national concept of conservation was begun and to a large extent, fostered by the Department of the Interior. Maj. J. W. Powell, a member of the staff of the Geological Survey, recommended through the Secretary of the Interior to the Congress in 1878 that the public domain should be classified as irrigable, timber, pasturage, mineral, and coal land. He made clear the fact that, even if the waters of our western areas were fully conserved and used, it would suffice to irrigate but a small part of the total area and that much of the remaining land could be used successfully only for pasturage. He strongly advocated the full conservation of the water and pointed out that it was water, not land, that was the lifeblood of the West.

Powell was bitterly attacked for making this declaration against the interest of the exploiters. The withdrawal of reservoir sites in western areas upon his insistence expressed a wise and farsighted conservation policy. This policy, however, was defeated by the Congress and most of the reservoirs were thrown back into the grab bag because the Nation was not yet sufficiently conservation-conscious. Out of the battles of that time and the Department of the Interior's agitation for the conservation of water, sentiment was gradually built up that led to the establishment of the Bureau of Reclamation in 1902, 24 years after such legislation had been recommended by Powell. It is also interesting to note that Powell proposed legislation in 1878 to establish pasturage districts similar to our present grazing districts, but more than a half century elapsed before such legislation was enacted.

Theodore Roosevelt in his autobiography says that the first work he took up when he became President was that of reclamation. Prior to the Reclamation Act all irrigation was under private auspices, but from 1902 the Federal Government has taken the leadership in this major field of conservation through the Department of the Interior. The successful conquering of the desert by husbanding for it life-giving water has given birth to a specialized agriculture which has made possible homes and a livelihood for many thousands of our population.

During the past 31 years the value of crops on Federal irrigation projects has been 10 times greater than the cost of the irrigation works which have served the land. Last year the return on these projects for each acre was two and a half times that received by the average farmer throughout the country.

I could give other examples of the many activities of the Department of the Interior in the interest of conservation as opposed to exploitation, such as the preservation of the coal lands of the West, the recognition of erosional processes in nature, the withdrawal of a large part of the timber lands now in the national forests on the recommendation of the Geological Survey, the preservation of mineral lands, the protection of water power sites, petroleum conservation and the various leasing acts, all tending to assure the prudent use of our national resources.

As part of his well-conceived and well worth-while plan to reorganize the executive departments in the interest of efficiency and economy, President Roosevelt has proposed that the name of the Department of the Interior be changed to that of Department of Conservation. Such a change would mean that for the first time in our history the conservation of our natural resources would be made the responsibility of a major department of the Government. Naturally we find this proposal bitterly opposed by those who have been given special privileges in the past with respect to our lands and forests and mines and who want to continue to exploit these and other resources for their personal enrichment.

The President's reorganization plan points the way. If the Congress, among the other powers that he seeks merely to make it possible to carry out properly the responsibilities which are his under the Constitution, gives him the opportunity to build up a Department of Conservation in the Federal Government, then we will indeed have taken a long step in the direction of protecting our resources and it would be possible to help man to conquer himself.

Resettlement on Milk River Project

ON JULY 30 the Milk River project was visited by a very distinguished delegation from Canada, including James Gardner, Prime Minister of Agriculture, and Norman Rodgers, Minister of Labor, both from Ottawa; G. W. Spence, Minister of Agriculture, Province of Alberta, and D. A. McNevin, M. P., from Saskatchewan, both of Regina, Saskatchewan, together with a number of newspaper men and others.

The principal object of the visit was to study the resettlement work in progress on the project in connection with the formulation of the Canadian agricultural policy. The Province of Saskatchewan is particularly hard hit by drought this year and this project was of particular interest to the visitors, as conditions in northern Montana are comparable with those in the neighboring province.

The resettlement activity on the Milk River project is gaining more and more publicity and visitors are numerous. So far the experiment has seemed to be successful; good crops generally are being produced by the new settlers; and they will no doubt, as a rule, be self-supporting this season and also be able to pay a fair crop rental to the Resettlement Administration. The Canadians were greatly impressed by the very extensive rehabilitation program which has been undertaken in the South Wagner area and particularly by the rather elaborate houses which have been provided for the clients.

There is an excellent crop on the project, probably the best in its history, and naturally this also made a favorable impression on the visitors. There is little irrigation in southern Saskatchewan and little possibility of irrigation development because of a very limited water supply.

CONSIDERABLE building activity is still in evidence on the Owyhee project. Two well-drilling outfits in the Mitchell Butte division alone are kept busy almost constantly.

President Roosevelt at Grand Coulee Dam

THE special train bearing President Roosevelt and his party left Spokane on the afternoon of October 2, after a day which was highlighted by his inspection tour of the Grand Coulee Dam on the Columbia River and the prediction that it would open new lands to thousands of desirable settlers from crop-poor lands of the Middle West.

Relating how he had seen the World's greatest man-made project on the Columbia River—Grand Coulee Dam—the President said, "I am certain of the future of the Northwest. Parts of the Nation are not so favored."

At the Grand Coulee the President looked over a promontory vista at the biggest project launched by his administration and said, "I am made very happy by the wonderful progress I have seen." Citing benefits of the project from a "national point of view", the President declared:

"We must remember that probably half of the total cost of this dam is paid to the factories east of the Mississippi River. * * * So in a correct sense it is a national undertaking and is doing a national good."

Viewing a crowd of about 5,000 persons on top of a hill overlooking the great concrete span the foundation of which is nearing completion, the President expressed the hope that some day there would be formed a "Grand Coulee Association" to be composed of workers on the project who would be awarded badges of honor because they were undertaking a job that would benefit the Nation for years to come.

Frank A. Banks, construction engineer of the Columbia Basin project for the Bureau of Reclamation, explained to the President the workings and power units. He then took the President to the observation point to look down on the pile of foundation concrete and machinery.—*Washington "Star."*

President Roosevelt views Grand Coulee Dam from Observation Point with Construction Engineer Banks.

BREEDING of Karakul sheep has been introduced recently in a small way to the Yakima Valley by a rancher on the Sunnyside division. The sheep are larger and more hardy than native sheep. When cross bred with native animals the wool crop is said to be increased by one-third.

CONSTRUCTION is to start soon on a 2-million dollar sugar factory on the Owyhee project. The new factory, which is to be built at Nyssa, Oreg., by the Amalgamated Sugar Co., will have a capacity of 2,000 tons of beets per day. It is planned to have the factory completed in time to care for the 1938 crop.

THE engineering department of the Montana State College has issued announcement of a short course in Diesel engines and tractors, to be given by the college this winter. For further information concerning this course enquiries should be addressed to the Montana State College, Bozeman, Mont.

Plant Behavior in Drought

By Wilbur W. Weed, Chief Landscape Gardener for Boulder City, Nevada

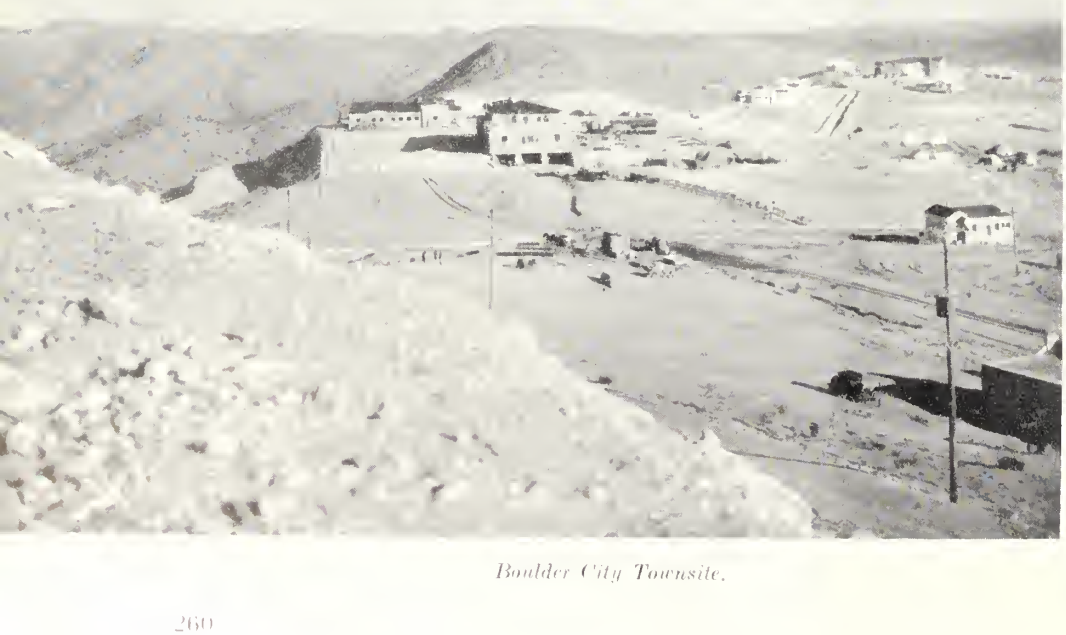
THIS material is based on personal research and observation conducted concurrently with and as an essential part of my professional duties as chief landscape gardener for the Bureau of Reclamation on the Boulder Canyon Project, Boulder City, Nev.

Boulder City was conceived and built by the Bureau of Reclamation to solve the problem of housing the great number of workers, engineers, and administrative employees engaged in the construction of Boulder Dam, power houses, and appurtenant works. The town site was located on an isolated and barren section of the Nevada desert where a land classification chart shows an overwhelming percentage of class VI soil and an almost negligible percentage of tillable agricultural soil of class I. Rainfall in this area amounts to 3 to 5 inches only a year, and humidity is low and air temperatures excessively high for long summer seasons.

The usual procedure under an assignment calling for landscape development in such a setting of adversity in nature would be to gather cactaceous plant material, assemble it, and install it in such arrangements as would give the greatest ameliorative value. The Bureau administration, however, set a different stage. It was required that a normal development, that is, exotic plant materials (trees, shrubs, and grasses), be used rather than cacti and other natives, for the reason that "we have enough desert, glaring sand, and cacti in the surrounding area without having to be further reminded of it." Based on this premise a large number of problems were presented for both immediate and future solution, the solving of which professionally is the background for this subject material.

The soil overlying the town site is not soil in a common sense but in truth finely divided rock material, so finely divided as to be classified as blow sand, very light in body and shifty in the wind. Decayed vegetable or animal matter is definitely absent. Decomposed granite constitutes the "subsoil" or underlying mass. The blow sand by natural movement in the extremely variable but moderately heavy and continuous winds normal to the vicinity filled the small valley and pocket between granite masses but left numerous outcrops. The outcrops were in various states of decomposition due to wind erosion and air slacking. Rough grading of acreage to be developed had to be immediately followed by fine grading and tying down.

Failure to tie down the sand either by finished development (seeding and planting and maintenance) or by constant artificial dampening resulted in great movement and loss of "soil." Consequently, it was made a practice of necessity to rough grade, finish grade, seed and plant, in one continuous operation of construction followed by continuous irrigation and drift fence maintenance to suit the situation. A policy of cooperating with nature rather than opposing it was adopted as a practical necessity in all phases of the work.



Boulder City Townsite.

LOCAL CONDITIONS GOVERN PLANTINGS

The choice of plant materials was definitely influenced by natural forces prevalent. Precedents and antecedents in horticultural practices under like conditions were found wanting or grossly inadequate. A composite of experiences, opinions, and surmises of leading horticulturists of the Southwest served in a way to draw boundary limits between the practical and impractical procedures. In general, those plant materials which have small thick, leathery leaves were chosen as suitable for use in that the foliage of this type would have less tendency to become anhydrous under desert conditions. In principle this theory proved correct. However, in securing a generous variety list of materials within this limitation errors in classification crept in to build up in losses of plant materials in the first growing season. It was rightly determined at the outset that the deciduous flowering shrubs of all kinds, such as Spirea, Syringa, Deutzia, Weigela, Forsythia, would not survive the rigors of desert summer. A few plants of this type were included in the purchase lists for physical check on theory. Purchase lists finally were limited to plants classified as broad-leaved evergreens, a group extensively used ornamentally on the Pacific coast, throughout California, north to Seattle, Wash., and east to Hood River, Oreg.; and in the Southwest and extreme Southern States.

Winter temperatures of below freezing placed some limitations on strictly native Californian materials. Shade trees chosen necessarily were deciduous in character, due to winter temperatures. *Ulmus pumila* (Chinese elm), *Populus monilifera*

(Carolina poplar), *Robinia pseudacacia* (black locust), *Melia azedarack umbraculiformis* (Texas umbrella), *Platanus orientalis* (European sycamore), and *Fraxinus velutina* (Arizona ash) were chosen and have been successfully grown, priority in value, everything considered, being in the order named. European sycamore, though highly rated by Pacific coast nurseries as suitable for inland arid regions, has proven distinctly unsuited, locally, as it is subject to burning (dehydrating) of its foliage. Arizona ash, grown very successfully in southern Arizona use, seems unable to assimilate plant food properly in sufficient quantity to produce normal growth. The Chinese elm has proven itself a valuable and perhaps the number one tree for inland arid planting. It is well adaptable to extremes of heat, drought, cold, or alkali. It responds quickly to plant food application, shapes up easily under light pruning and will stand up well under abuse and neglect. Density of foliage for shade requirements is in excellent combination with its ornamental value. Carolina poplar, being related to that desert planting standby cottonwood, finds use and proves itself for desert planting, if plenty of water is made available to it. Shade on the desert can be quickly acquired by using trees of this family for temporary growth while slower kinds are reaching useful maturity.

The cottonwood was ruled out of the local picture because of the fire hazard created by the "cotton." True cottonless cotton wood trees (Thornber) were not found available in quantity nor was the stock offered guaranteed true to type. The ordinary cottonwood being a gross feeder, and creating a dense shade, was found not suitable for ornamental planting comparable with the Carolina poplar. The cottonwood's very brittle wood structure and tendency to break down in high winds is a distinct liability in its use and maintenance as an ornamental tree.

IMPORTANCE OF AIR CIRCULATION

The black locust proved hardy and drought resistant. It blossoms freely under all conditions and responds readily to heavy feeding and to pruning for shape. It is of moderately slow growth under drought but is persistent in its gains. It makes a faster and more supple growth under plenty of water. However, suppleness of trunk which accompanies rapid growth of this tree is such a disadvantage in trunk training as to offset gains made in spread of top through such forcing. The Texas umbrella tree is familiar to most desert sections as a standard for maximum density of shade. Its crown, naturally symmetrically shaped, has a marked ornamental value, in flower and out.

Boulder City, a transformation from desert to a city beautiful.

Air in circulation, even though it be warm air, is a prime requisite for comfort in arid regions. Nature sends air currents rushing from one section to another in a constant game of balancing air temperatures. A common development of the home site in arid sections finds the house and surroundings completely hemmed in by squatty growth of shrub and tree. The shade is dense, which was the prime reason for the planting. Air circulation is at a minimum, however, and heat suffering is usually intense and the only relief afforded is from sun glare. Pruning the trees for shape and encouragement of growth in desired directions will play an important part in promoting and maintaining air circulation in like situations. The head of the tree must be well off the ground. The shade cast is proportional to the spread of the top of the tree; and the high head, while permitting air circulation along the ground in the human life zone, changes the location of the shaded area away from the trunk instead of close to it.

Under most drought conditions heavy irrigation is the rule at the spot of oasis. Generally an abnormal, weak, and excessive growth of stem and foliage follows. This weakness of growth is also attributable in part to the impracticability of making a food supply available in sufficient quantity to balance the heavy moisture consumption. Shallow root systems lying close to the top of the ground to take advantage of surface irrigation require that tree tops be kept low and thin. Heavy fluctuations in intensity and sharp directional changes of seasonal winds may also contribute to the requirements for a well-balanced tree top. Thinning by pruning to offer a maximum of shade with a minimum of foliage density enhances both utilitarian and ornamental values of the shade tree under these conditions.

An important plant behavior under conditions of aridity, low humidity, and high air temperatures observed in this research has to do with seasonal growth. Normally best and most prolific plant growth seems to set on in air temperatures of between 50° and 76° F. Under desert conditions of 84° minimum temperature common in a long summer season on the Nevada desert, plant metabolism is observed to become upset. A normal dormant season for deciduous plant materials and a rest period for broad-leaved evergreen and coniferous evergreen plants begins in the fall and continues through the winter season. Growth and development occurs in the opposite seasons of spring and summer, normally. Under observed conditions two dormant seasons are manifest.

The abnormal dormant season is in the middle portion of the intense heat period and follows a short growing season. The spring growing season starts early on the

[illegible] of an exceptionally short normal winter dormant period. The length of the spring growing period is dependent on the early or late approach of the summer heat. When minimum air temperatures pass 70° an immediate slowing up and stoppage of growth is apparent in all plant materials. This condition, called in this study the abnormal dormant season, is true even under irrigation and a human struggle to keep foliage dehydration from setting in begins. At the end of the intense heat, when minimum temperatures drop to the 70's (° F.) again an active and prolonged and highly satisfactory plant growth is commenced. Then the normal winter dormant season follows, late and slow in reaching completeness. The metabolic upset thus described adds not a little to the horticulturist's problems.

ORNAMENTAL TREES PLANTED

Coniferous evergreen trees, arborvitae and cypress mostly, were installed on the business streets of Boulder City as ornamentals. The varieties used were *Thuya beverlyensis* and *Supressus guadalupensis*, respectively. Each thrives very well under drought conditions current in the problem, especially the arborvitae. Applied plant food in the form of commercial fertilizers proved a detriment to good growth and a fine living was generally drawn by the tree from dry and poor soils. It was found that the coniferous trees could be "drowned" by overwatering. The irrigation of the evergreen street trees had to be finely gaged by the condition of the foliage and general appearance of the growth. The coniferous evergreens responded to pruning for shape and density of foliage in a satisfactory manner. Most pruning was light and done with hedge shears.

Broad-leaved evergreen shrubs in most of the varieties on purchase lists survived but many kinds have failed to put on either root or top growth over a period of years. Some varieties with the thickest leaves took the shortest period to oblivion. Extremely low humidity and consequent dehydration of foliage is the underlying cause for most plant material losses in this situation. Ground moisture can be kept almost constant by irrigation. Daily ground evaporation can be equalled and passed but one cannot hurry moisture through a plant assimilative system. If the cellular density of the leaf is sparse or the output by evaporation from leaf area passes the plant's volume capacity, dehydration results. Those plants with a great volume of small leaves as *Myrtus communis mycrophylla* (small-leaved Roman myrtle) do well under extreme high air temperatures with ground moisture available because of large capacity for replenishment of moisture losses in foliage.

An important contributing factor in plant material losses in areas plagued with shifting sands is the burying effect of piled up soil. The drift of topsoil or blow sand stops at a barricade formed by a planted group or the moisture barricade resultant from irrigation. The leading edge of the developed area (that is, the edge nearest direction of prevailing wind) becomes a trap for the wind-carried particles. A minute but persistent build-up of soil level results, varying in width with the velocity of the soil carrying wind and the effectiveness of the barricade. Locally this build up of soil elevation is at the rate of 1½ inches per year and for a depth in width of 100 feet from the leading edge. Plant materials in the built-up area have their root crowns buried to a suffocation depth in a short time. Regrading or at least cupping to normal planted depth above the root spread area is necessary. The nonprofessional is prone to overlook this circumstance as a cause for plant decease.

EVEN IRRIGATIONS HIGHLY IMPORTANT

Irrigation practice is another definite starting point for a policy of cooperation with nature as against opposition to it. Irrigation becomes a highly technical business when correlated to success in growing plant materials under desert or drought conditions. Evenness of distribution outweighs in importance quantity of application. Method of distribution has a distinct bearing on evenness of distribution. In all cases the human element affects results. Under desert conditions a fine balance must exist between daily surface evaporation, soil absorption by attraction, and plant consumption. This balance is extremely difficult to compensate, and varies definitely with the season and with daily conditions of wind and humidity. A low-lying ground wind gathers reflected heat from undeveloped areas, air masses are heated above normal, and a drying and burning effect sweeps across the developed area to the detriment of plant materials thereon. Wind velocity affects the distribution of water by sprinkler systems both beneficially and detrimentally.

A light breeze with its base 5 to 7 feet off the ground carries no silicious material and serves beneficially to break up water columns emanating from sprinkler nozzles. The low-lying strong ground wind, however, serves to carry loose dust or soils from the undeveloped area for deposit on the developed area and to alter the point of rest of sprinkler-distributed water. Continuity of wind from a particular compass point or expectancy of a majority of the total air movement from that point will definitely affect the design of sprinkler systems calculated to afford 100 percent coverage.

Overirrigation, that is, applying more than can readily be absorbed or is evaporated is equally as damaging as underirrigation. High air temperature affects water temperature of surpluses lying on the surface unabsorbed. Grass foliage is immediately affected adversely by scalding water. The unthinking gardener may also destroy plant material in quantity by using a hose without first dispelling hot water therefrom when the hose has been exposed to hot sun for a period.

An important relation exists between relative humidity, air temperature, and evaporation factors and the advisable irrigation period of the day. Where humidity is low and evaporation high because of high air temperature or drying winds overhead irrigation can be safely done in sun heat and is in fact desirable. Pace can be kept with evaporation losses and the fiber deteriorating effect of alternate wetting and drying be somewhat overcome. Where humidity is high irrigation in maximum sun intensity may cause foliage burn by magnification of heat rays through water globules on foliage. Night watering in high humidity and desert heat is a cause for morning mildew. Early morning watering is more beneficial under the latter condition. The trial and error method coupled with a keen analytical observation of results is quite necessary in reaching a successful conclusion in desert irrigation problems. The practice evolved must duplicate ideal natural growing conditions for finest degree of success.

Ground covers and grass seeds have required a great share of study in meeting

NOTICE

Beginning with the issue of January 1938, the subscription price of the Reclamation Era will be as follows:

To water users on the Federal Reclamation projects, 50 cents;

To others in the United States, its possessions, and reciprocal countries, $1.00;

To subscribers in foreign countries not holding reciprocal relations with the United States, an additional charge of 36 cents to cover postal charges.

This notice affects all new subscriptions and renewals.

local requirements of development. Necessary irrigation practice causes a shallow root development at best in all classes of plant materials. The normally shallow rooted grasses are eliminated at the outset and the normally deep rooted grasses enter the elimination contest. The soils in this problem were particularly devoid of plant food in sustaining available quantities. This fact was proven by soil analysis and verified by trial plantings. Grass seed sown in unfertilized soils germinated promptly and grew to a height of three-fourths inch in a very short period under proper conditions of air temperature and moisture At this point a definite stoppage of growth indicated that plant food contained within the seed kernel was exhausted and that sustaining quantities from the soil were not available.

GRASS PLANTING

Combinations of lawn grasses were planted, each variety of seed having a desirable characteristic or offsetting an undesirable characteristic of its companion or companions in the combination. After trial of fescues (Festuca species and *F. Pratensis*), rye, red top (*Agrostis alba*), and white clover in many combinations, a perennial rye grass (*Lolium perenne* Pacey) was used as a base with white Dutch clover (*Trifolium repens*) added. This was found best suited for local conditions of soil and climate. White Dutch clover is not a grass but added to the rye grass base lawn at the beginning of the second growing season it aids materially in keeping a rich green color on the developed area and in turn builds nitrogen in the soil for the benefit of the other grass. The clover would not survive planted alone or when planted in combination initially. The clover with generous irrigation holds up well under desert heat and acts somewhat as a nurse crop for grasses with less stamina. The clover will not stand traffic but when subjected to traffic recovers quickly when the abuse is lifted. Any discussion of grass planting in the desert brings up the question of Bermuda grass (*Cynodon dactylon*) suitability. In the belief that no conscientious horticulturist knowing all its disadvantages would without compulsion recommend its use, this reviewer is willing to limit comments made thereon. Bermuda grass is a ground cover, nothing more. In this problem it has been successfully done without. In most desert situations the winters are very nominal in severity and the clover and rye combination stays green throughout the year. Bermuda grass is a total loss in lawn value from early fall to late spring. The usual procedure where winter lawns are required following a Bermuda summer lawn is to renovate the Bermuda sod and sow in Italian rye grass (*Lolium multiflorum*), an annual, for winter sod. This proves an expensive arrangement in that it means a new lawn each fall. The rye and clover lawn has its losses in summer heat, it is true, but at the most such a lawn requires but spot seeding each fall to restore 100 percent coverage and this is done at a minimum of expense.

SELECTING FERTILIZER

The problem of choosing a suitable fertilizer is one of the first to meet and solve when reclaiming desert soils to profitable or ornamental use. Water supply and distribution seems to merit first consideration but a method and means of furnishing plant food is surely second in importance or equal in rank to irrigation. It was necessary to add humus to the sand in the subject problem to give the "soil" substance or body, and weight. The sand needed weight to hold it down. No deposits of clay or heavy soils were available for hauling in and mixing with the sand. Peat moss was added by manual mixing to give body, weight, and moisture-holding properties to the surface areas. Chopped hay and straw were used on other test plots. None of these materials could be kept down even under sprinkler irrigation until the seeding could be accomplished. The least drying of the surface in wind and sun caused the added materials to be scattered and lost. Excess irrigation floated the peat moss to the surface where it, too, soon became a plaything of the wind. Available supplies of animal fertilizers used on test plots brought in excessive amounts of weed seed infestation, particularly Bermuda grass, and caused a great deal of loss by burning. In natural dryness here decomposition of organic manures and subsequent availability of fertilizing values is exceptionally slow. A shift to commercial fertilizers, ammonium sulphate, treble super-phosphate, and potash, each element applied separately but the lot applied coincident with grading and seeding, gave the most satisfactory results. Humus content has been built up gradually through fallen grass cuttings and decaying grass roots in seasonal rebuilding of large areas. Decay of organic material by composting was unsatisfactory because of air dryness.

Commercial fertilizer application was made on the surface and percolation was by washing down in the normal course of irrigation. The elements of the commercial fertilizers were purchased separately to avoid buying nonessential fillers.

PLANT BEHAVIOR

The peculiar plant behavior caused by seasonal variances in natural conditions in this particular setting makes fertilizing and especially the use of commercial fertilizers in the practice of plant feeding a precarious business Conditions of air temperature and humidity and ground moisture content must be finely gaged. Heavy irrigation in sandy soil leaches away quantities of plant foods before availability or absorption. Numerous programs of light feeding prove better than few periods of heavy feeding under these conditions. In any event feeding in the heat of desert summer sun during the abnormal dormant season previously discussed herein is strictly fatal to plant life.

Insect pests and diseases are at a minimum in the desert where humidity is low and vast areas of barren lands predominate. Almost as scarce as flies and mosquitoes and plant insects are flowers, annual, biennial, or perennial. Wind, sand, heat, and resultant aridity are the four horsemen of the desert in a great conspiracy against the floriculturist, amateur or professional. The climatic conditions appear as enervating to plant life as they are to human life. The nonhorticultural solution of planting a concrete lawn and painting it green finds its most willing followers under such conditions of adversity.

Other subjects concerning plant behavior in conditions of extreme drought have been observed that must go untouched in this short discussion by reason that the study thereof is not complete. A great new period for observation in the subject problem is now opening up. With the storing of water behind Boulder Dam, the world's largest artificial lake is forming. The great local weather question is about to be answered. "Will the existence of Lake Mead change weather conditions of adjacent areas?" Boulder City residents in general claim to note increases in humidity. Summer thunderstorms and summer precipitations are apparently on the increase. What will the plant life reaction to increased humidity be? First formation of mildew on lawns appeared in the summer of 1936.

For the first growing season the berried ornamental plants set on berries and held them. The berries matured, colored, and served ornamental purposes. It will be interesting to follow reactions of plant life with the changes of humidity, if any, in comparison with their behaviors of record and reported herein.

In reclamation or development of desert areas the practicing horticulturist must recognize the limitations of man; must cooperate with, rather than work against, nature; must duplicate, as nearly as possible or practical physically and economically, the natural phenomena and conditions of growth. Maintenance must be planned as carefully as is construction, and the economical and physical limitations of maintenance must not be exceeded by the enthusiasm of the construction period.

The Shoshone Canyon Conduit of the Shoshone Irrigation Project, Wyoming

By I. B. Hosig, Engineer, Bureau of Reclamation

THREE miles west of Cody, Wyo., the Rattlesnake-Cedar Mountain ridge begins its 4,000-foot rise from the plains of the Big Horn Basin. This ridge locally is a tilted fault block. On the uplifted back side the capping sediments dip uniformly eastward toward the Big Horn Basin. Near the escarpment the beds are contorted by drag folding. The valley upstream from the fault is relatively broad since the underlying, down-dropped sediments offered little resistance to the combined scour of the two tributaries joining within the area and this basin forms the site of the Shoshone Reservoir. Eastward and downstream the Shoshone River encountered granite beneath the capping sediment, which indicated a vertical uplift of approximately 3,000 feet along the fault. In the hard granite the river was only able to cut a narrow canyon, which farther down gradually opens as the overlying eastward dipping sediments are reached. The entire canyon, including the granite and sedimentary areas, is about 7 miles long, the Shoshone Dam being located near the head of this picturesque portion of the scenic road to the eastern entrance of Yellowstone National Park. The dam raises the water about 230 feet, plugging the outlet of the basin to form the Shoshone Reservoir with a capacity of 456,600 acre-feet. The reservoir is the heart of the Shoshone Irrigation project.

The developed portion of this project comprises about 67,000 acres of irrigable land located in the northern part of the Big Horn basin around the towns of Powell, Frannie, and Deaver at distances of 20 to 60 miles from the dam. Water for these lands is turned into the river at the dam and diverted to the left and right banks at the Corbett and Willwood diversion dams 15 and 20 miles downstream, respectively. Private diversions still farther downstream supply an additional irrigable area of 50,000 acres lying about the towns of Byron, Cowley, and Lovell.

These irrigable areas, together with about 15,000 acres around and above Cody, which have diversions from the South Fork above the reservoir, constitute the low-lying arable lands of the Shoshone River valley. They have never experienced a water shortage and are but a light load for that magnificent stream from the "Shining Mountains" as the Absarokee mountains were called by the Indians in allusion to their gleaming snow fields.

Additional irrigable areas totaling 90,000 acres lie above the present canals of the project and over divides in the valleys of Dry Creek and Greybull River to the south and the valley of the Clarks Fork of the Yellowstone River to the north. They await development through a high-line canal system. That canal system heads at the Shoshone Dam on a grade contour 125 feet above stream bed at that point. The grade contour reaches the mouth of the canyon after a traverse of about 3 miles at an elevation 230 feet above stream bed and about at the elevation of the highest terrace or bench of the Shoshone River valley. The writer knows of no other valley of the magnitude of the Shoshone Valley where the history of the successive lateral meanders of a stream is so largely and clearly perpetuated by benches. The benches make steps of 50- to 75-foot rise and ¼-mile to 5-mile tread. At places they have been modified by side-stream cuts and fills but they still dominate the topography. At the greatest swell of the alluvial part of the valley in the vicinity of Powell their combined width is 20 miles which is two-thirds of the total width of the valley. At the mouth of the canyon their width is less than a mile.

Owing to the narrowness of the canyon, it was obvious that a single conduit through it including diversion works and a river crossing at the mouth would cost less than two conduit lines, one on each side of the river. Because of a bend in the canyon, the line on the south side of the river is on the inside arc and was chosen for the location of the joint line, although the land now to be developed and the bigger peak-load requirement are on the north side. The north side lands

Heart Mountain Division, Shoshone Project. Natural cave in Shoshone Canyon Conduit looking ahead for Station 140.

constitute the Heart Mountain division of the project. The joint canal line is now called the Shoshone Canyon conduit.

CONDUIT LINE 14,720 FEET LONG

Preliminary plans contemplated that the conduit be a tunnel section through the granite core of the uplift and through two ridges where limestone bluffs narrowed the canyon; elsewhere it was to be a cut-and-cover section. In the more intensive study and prospecting of final location, it became obvious that one continuous tunnel would not cost much more than the original proposal and undoubtedly would be less subject to landslide hazards and, hence, probably would have less operation and maintenance costs. The landslide hazard was especially serious along the lower mile of conduit as a break would not only damage the conduit but probably also would damage seriously the Cody-Yellowstone Park highway which runs roughly parallel to it in steep side-hill location on a grade line 100 feet lower. The adopted tunnel or conduit line is 14,720 feet long. Its upper end is a tunnel about 100 feet above stream bed driven around the Shoshone Dam in 1910 for the immediate purpose of affording a passageway to bypass the driftwood collected with the first filling of the reservoir. Upon the completion of this use, the tunnel was plugged off near its upper end. This readily permits the joining of the old with the new work and the installation of the gates, leaving only the work of the removal of the plug and construction of a trash rack as items to be built in a limited time when the reservoir must be held at a low stage. The lower end of the conduit is on a line with the proposed siphon crossing of the canyon. Besides being the division point for the Heart Mountain and Oregon Basin supply canals, this end will be the take-off for a wasteway return to the river and a possible take-off for a power development.

A small deviation from the most desirable alinement is necessary to avoid passing under the Shoshone Cavern National Monument. This is an area embracing an unexploited and as yet not thoroughly explored system of caves known as Frost Cave, the mouth of which is about 1,000 feet above grade line. The preservation of this area as a national monument is owing to the foresight and energy of the early builders of the Shoshone project, notable D. W. Cole, construction engineer of the Shoshone Dam.

In the local geological column the granite at the horizon of the dam is 4,500 feet below the strata which is the present top and east slope of the Cedar-Rattlesnake Mountains ridge and against which the highest terrace feathers out. The tunnel must pass through most of this column. Roughly it is as follows:[1]

Thickness of bed in feet	Formation	System
1,300	Granite	Pre-Cambrian.
145	Flathead sandstones	Middle Cambrian.
575	Gross Ventre shales	Middle Cambrian.
510	Gallatin limestone	Upper Cambrian.
450	Big Horn dolomite	Upper Ordovician.
180	Three Fork limestone	Upper Devonian.
900	Madison limestone	Mississipian.
170	Amsden formation	Mississipian.
180	Tensleep sandstone	Pennsylvanian.

Additionally, the river was trenched 250 feet below the highest terrace exposing at the mouth of the canyon the Ember limestone and the Chugwater or old red beds formations which lie on top of the Tensleep sandstone. The latter formation frequently exposed along the Rocky Mountain front often contains hot springs and the Shoshone River section is unusually well supplied. The river bottom from the siphon crossing downstream for a distance of a mile fairly boils with them. Some are very large and their total outflow is estimated at 90 cubic feet per second. When the highest terrace was being built, the vents were at that level and they formed a hot-springs terrace, fragments of which indicate that it had an area of upwards of 1 square mile and was comparable to similar phenomena in the Yellowstone Park. As the river trenched deeper and deeper, cutting the successive terraces, the springs dropped with it forming corresponding hot springs terraces at the mouth of the canyon. The highway crosses such a terrace which is still devoid of vegetation and upon which the extinct hot springs cones appear as though water had left them but yesterday. The material is mostly travertine and the total volume, all material brought from within the earth, probably would be measured in millions of cubic yards. Gases, notably hydrogen sulphide and carbon dioxide are also brought forth with the water. The former gas under favorable conditions (unfavorable to the senses) may be smelled at Powell 25 miles downstream and gives point to the familiar name "Stinking Water River." Mixed with the more common thermal deposits are sulphur and gypsum. Pieces of rock containing pure sulphur in quantity sufficient to continue burning, after having been lighted with a match, may be picked from cuts along the highway. Before the development of sulphur mining by means of wells in Texas and Louisiana, these sulphur deposits were worked commercially, but the cheaper supply has made operation unprofitable and the mills are shut down. The nature of the deposits as revealed by shallow cuts is not obvious, but they appear to be a heterogeneous mixture of sulphur blobs, limestone blocks, and gypsum, much of which is in fair-sized crystals. Such a deposit might occur were the mixture the crumbled residue of a limestone strata, in which much of the limestone had been replaced by sulphur and gypsum prior to the breaking down of the strata and from which most of the remaining limestone had been removed by ground-water leaching.

The concrete-lined tunnel is to have a 12-foot horseshoe section and a capacity of 1,200 cubic feet per second. The normal lining is to have a minimum thickness of 6 inches. Support for ordinary soft ground consists of 3-inch timber lagging held in place by 5-inch 10.0 I-beam steel sets curved to clear the finished section by 6 inches and supported at the invert corners by steel plates resting on timber sills. The sets are spaced as the loading dictates. Very soft ground has not been encountered but plans to combat it contemplated a circular section and segmental pressed-steel-plate liners.

WORK DONE IN TWO SECTIONS

Work on the present contract begins at station 8. In view of his equipment, the contractor elected to divide the job in two parts, driving about half the tunnel from headings right and left of an adit intersecting at station 44+34 and the remainder from an adit intersecting at station 121. Under this arrangement one plant sufficed for the work. The full section is driven at one operation. Drilling is done from a track-truck jumbo on which six drills are mounted. Mucking is a power operation job and muck trains are moved by electric storage-battery-powered locomotives. All power is obtained from the Shoshone power plant. Interchange of drill rig and mucking machine between the two headings keeps both pieces of equipment busy and is the key to driving operations. The normal output per day of the combined equipment is three rounds of about 12 feet each. Ventilation is principally by means of a suction system, each heading having its own sheet metal pipe line and independent fan at the mouth of the adit. After each blast, compressed air is discharged near the heading to assist in removing the noxious gases from the working area.

Work from the upper adit was principally in granite, sandstone, and shale. Work from the lower adit has been principally in limestones and while the possibility of encountering underground caverns was recognized, there seemed to be no reason for either attempting to find them

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[1] From Geology of the Mountain Uplift Transacted by the Shoshone Canyon, Wyo., by G. Duncan Johnson, Journal of Geology, vol. 42, p. 809.

Clear Creek Reservoir area thoroughly cleared of dead timber by C. C. C., Yakima Project, Washington.

The Future of the Civilian Conservation Corps

By Alfred R. Golzé, Supervising Engineer, C. C. C.

JUNE 30, 1937, terminated the existence of one of the first of the 1933 emergency measures — the Emergency Conservation Work organization.

During its 4 years and 3 months of activity, the Emergency Conservation Work developed its splendid record of achievement on a conservation program of great national favor by the operation throughout the Nation of work camps for young men. Because of the nature of these camps, they soon became known as Civilian Conservation Corps camps, or more briefly and popularly, C. C. C. camps.

It seemed only natural that in June 1937, when Congress completed legislation to continue the conservation work of the former emergency bureau, the name selected for the agency should be the Civilian Conservation Corps. The C. C. C. Act (Public, No. 163, 75th Cong.), approved on June 28, 1937, provides that the work of the C. C. C. shall be continued for a period of 3 years from July 1, 1937. This new C. C. C. act contains 18 sections setting forth in detail the basic provisions for operating the Corps. The act provides for carrying on the Emergency Conservation Work, but with a number of important changes.

Enrollment in the Corps is no longer confined to boys on relief. Youthful citizens who are unemployed and in need of relief form the main body of C. C. C. enrollees. War veterans and Indians are admitted in limited numbers. The maximum permissible enrollment fixed by statute at 315,000 men is divided into 270,000 juniors, 30,000 war veterans, 10,000 Indians, and 5,000 men in the territories and insular possessions. Junior enrollees must be unmarried and between the ages of 17 and 23, all other enrollees are exempt from the age and marital provisions.

Excepting the war veterans and five Army facilitating men in each camp, all C. C. C. enrollments are for a period of not less than 6 months, but not to exceed 2 years. A recent decision of the Acting Comptroller General has held that service in the Corps, while it was a part of the Emergency Conservation Work organization, has no bearing on service in the C. C. C. after July 1, 1937. This ruling has permitted many boys who had completed 2 years or more in the C. C. C. on June 30, 1937, to remain for 2 years more if they meet the age and other requirements.

The Director of the Civilian Conservation Corps, appointed by the President and confirmed by the Senate, has complete and final administrative authority in supervising the operation of the Corps, subject only to such rules and regulations as may be prescribed by the President. In accordance with the provisions of the act, the cooperation of existing Government departments will be continued in the future operation of the C. C. C. camps. The War Department is charged with the responsibility of housing and feeding the men and with all matters relating to health and transportation. The Labor Department is the active agent for selecting the boys to enroll in the C. C. C. The Department of the Interior and Department of Agriculture, through their various bureaus, will continue to direct the work projects on conservation activities and to provide job training.

PURPOSES OF THE C. C. C.

The purpose of the Civilian Conservation Corps is primarily twofold. In addition to providing for employment and vocational training to the men, useful public work is being accomplished in connection with the conservation and development of the natural resources of the United States, its Territories and insular possessions. It is expected that in the future more time will be devoted to the educational features of camp life. Teaching of the boys while "on the job" is a fine, practical method of preparing the men to earn their own way in later life. "On-the-job" training is followed up by whatever classroom work is desirable. Increasing voluntary attendance of the enrollees at the job training classes during the past year has indicated that this phase of their camp life is growing in appeal, and excellent results are anticipated.

Since the first C. C. C. camp began operation on a Reclamation project in May 1934, the efforts of the enrollees in the Reclamation camps have been concentrated on works designed to be of permanent value to the project and to increase the security and stability of the Government's investment in Federal Reclamation. The recent period of dry years in many parts of the West, coupled with the effects of the depression, has developed conditions indicating that there is ample opportunity for the Civilian Conservation Corps to participate in improvement of conditions on Reclamation projects.

In the past 3 years, camps have been established on nearly every Federal Reclamation project, which, constituting as they do the practical conservation of soil and water, offer an ideal field for

C. C. C. work. C. C. C. enrollees have accomplished a vast amount of urgent construction work on the irrigation distribution systems and also much related work seeking to improve the condition of the projects. A summary of past accomplishments appeared in the September issue of the ERA.

Federal Reclamation Crops

FEDERAL Reclamation projects during 1936 contained one-half of 1 percent of the total cropped acreage in the United States, but they produced crops worth 1.3 percent of the total value of all crops in the country.

Of the big staple crops, which dominate some other areas of the Nation, the Federal projects produced negligible quantities; of corn one-half of 1 percent of the total; of wheat 0.7 of 1 percent; and of cotton 1.4 percent.

Of the specialty crops, however, these project lands produced appreciable quantities. They produced 10.9 percent of the Nation's sugar beets; 9.1 percent of its alfalfa seed; 6.8 percent of its pears; 7.8 percent of its clover seed.

The following table will show how some of the major crops of the Federal projects compared with the national totals:

Comparative Statistics on Principal Crops for the Entire United States and Federal Reclamation Projects, Season of 1936

	Entire United States	Federal Reclamation projects[1]	Percent Reclamation projects
Crops ... value	$6,084,932,000	$78,902,818	1.3
Do. ... acres	315,068,000	1,629,174	.5
Corn ... bushels	1,524,317,000	1,730,232	.1
Wheat ... do	626,461,000	4,374,435	.7
Barley ... do	147,452,000	2,009,983	1.4
Oats ... do	789,100,000	2,130,760	.3
Rye ... do	25,554,000	18,161	0
Alfalfa seed ... do	860,000	77,798	9.1
Flax ... do	5,908,000	12,073	0
Hay ... tons	70 224,000	105,400	.1
Alfalfa ... do	24,750,000	1,540,796	6.2
Sweet clover seed ... bushels	699,000	54,956	7.8
Beans ... do	18,537,000	621,234	3.3
Potatoes ... do	329,997,000	12,997,951	3.9
Apples ... do	108,031,000	5,155,306	4.8
Pears ... do	24,128,000	1,637,872	6.8
Peaches ... do	46,118,000	730,985	1.6
Sugar beets ... tons	9,177,000	1,003,176	10.9
Cotton ... bales	12,407,000	176,449	1.4

[1] Warren Act lands are not included.

Irrigation flume built by C. C. C. over drainage canal, Newlands Project, Nevada.

Shoshone Canyon Conduit

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or to avoid them. Small caves were encountered in both headings soon after the excavation reached the tunnel line. At 1,700 feet west, an opening was made into a large cave which parallels the tunnel and which opens into it at intervals for a distance of 100 feet. Still farther west additional small caves were encountered. This section is opposite the Shoshone Cavern National Monument.

In the east heading more spectacular and disturbing conditions were encountered. A number of small caves carrying carbon-dioxide gas were encountered. The gas appears to have been the cause of bad air conditions which caused two fatalities. About 800 feet in, sulphur deposits were encountered. At one set-up where "dry drilling" was being practiced, sulphur powder from the drills which accumulated at the face was set off in a bluish flash, like a photographer's magnesium flash, by a spark from a drill. The resulting consternation may be imagined. Fortunately there were no fatalities. At 1,760 feet in, a large cave with sulphur deposits was again encountered. During a Sunday shut-down, a careless visitor tossed a cigarette stub to the floor of the cave and set a sulphur deposit afire. A 3-day interruption of work resulted. The issuing sulphur dioxide fumes filled the east heading and adit and extended some distance into the west heading. The resulting excitement and apprehensions concerning inextinguishable fires of brimstone in the bowels of the earth causing irreparable damage to the project may well be imagined. A representative of the Bureau of Mines with proper equipment and experience in such situations was called and made an investigation. He found that the fire had been extinguished, probably by material falling on it and suggested improved methods of procedure and new arrangements of the ventilating system so that work could be resumed. At 1,820 feet in, another cavern was encountered which extends for 223 feet along line and is 60 feet wide by 80 feet high. It required a large quantity of the muck from the west heading to fill the cave to tunnel grade so that the track could be carried across it and "tunneling" could be resumed. Several more large caves lying to the south of line were broken into before the east heading reached the east portal. At this writing, the west heading has passed the Shoshone Cavern without disclosing additional large caves.

The present work was started with a W. P. A. allotment by the Bureau of Reclamation in the fall of 1935. W. F. Kemp is construction engineer and the Utah Construction Co. of Ogden, Utah, is the contractor, V. M. Samuels being the construction superintendent, J. M. Petral the office manager, and Jack Stone the tunnel foreman.

Address of President O. S. Warden, Annual Convention of National Reclamation Association, Casper, Wyo., October 12–13–14, 1937

THE 14 Western States that have membership in the National Reclamation Association make a big ranch. There are 600,000,000 acres of land in this wide and deep western country—one-third of the area of continental United States—a group of States as large as an eastern section from the Atlantic Ocean to the Ohio River. The other day I pulled histories down from the shelves to rediscover how Uncle Sam acquired the territory we are now trying to make fit for homes and cities. It is an interesting investment story.

EARLY ACQUISITION OF LAND

The early Presidents began to buy large chunks of land, adding to the territory acquired from Great Britain by treaty at the close of the Revolutionary War. President Jefferson, a firm believer in the value of land, took 15 million dollars from the Federal Treasury and gave it to Napoleon for the so-called Louisiana Purchase. In that area there was included North Dakota, Nebraska, and parts of Montana, Wyoming, and Colorado, west of the Rockies. By discovery and settlement 300,000 square miles were acquired within the present States of Washington, Oregon, Idaho, western Montana, and Wyoming. Texas seceded from Mexico. After the War with Mexico, the United States augmented its western domain by more than 500,000 square miles in New Mexico, Arizona, California, Nevada, Utah, and Colorado. There was a cash item in the deal at the end of the trouble with our neighbor at the south of 15 million dollars. Through the Gadsden Purchase a few years later we were able to buy a part of southern Arizona and New Mexico for 10 million dollars. To summarize Uncle Sam purchased a vast western empire at a cash cost of 40 million dollars.

If you care to make up a purely western balance sheet, you may reckon how much of the Louisiana Purchase budget should go over against parts of Louisiana, Arkansas, Missouri, Iowa, western Minnesota and South Dakota. Subtract that sum from the 15 million dollars that Mr. Jefferson gave to Napoleon for the whole tract. There is only one point to this historic land review. Were these early-day purchases worth the while? Let the 1937 taxable valuations in the 14 States that belong to our organization answer the question. Observe that the Government, after these many years, owns 52 percent of this land in the West. The problem of the moment, then, is what more shall we do about this land what are the potential values of the West unrealized? The answer, in a word, is reclamation.

BEGINNING OF FEDERAL RECLAMATION

The reclamation story, as you know, begins with the Spanish missionaries in California and Arizona. The Mormons assisted agriculture by the diversion of water to the land. There has now been invested in the irrigation of western lands more than a billion dollars. One-fourth of this sum has been advanced by the Federal Government—three-fourths is the investment of private capital. We have learned much by experience. Former President Theodore Roosevelt was the father of reclamation. If President Franklin D. Roosevelt, and all Presidents to come, will stand upon the platform that was written into the 1902 message which persuaded the Congress to establish the Bureau of Reclamation, the West will be satisfied. In 36 years there has been no need to change the declaration of Theodore Roosevelt who sent these prophetic words to the Congress:

"The reclamation and settlement of the arid lands will enrich every portion of our country."

FUNDAMENTALS OF RECLAMATION

This, my friends, is the 1937 formula of the National Reclamation Association. At the opening of this sixth annual convention we cling to the selfsame fundamental pronouncement. Five years ago a group of western Governors met and rocked the cradle of this organization. That was a good day for reclamation. We do not need to change the principles of our constitution. The veterans of reclamation declared that the purposes of this association are to promote the cause of reclamation—to cooperate with and assist the Federal Bureau of Reclamation in bringing about a speedy completion of projects—to urge the adoption of desirable Federal legislation. These have been and are the unchanging rules of the National Reclamation Association. There have been, and always will be, differing opinions about the merit of this or that project, or the desirable appropriations of a particular session of the Congress. These recurring circumstances, however, should not and must not—if we are to continually succeed—prevent a united support of the combined judgment of the Bureau of Reclamation and the National Reclamation Association, supporting a selective group of expenditures at any particular time. It is as clear as the sun at noonday that the association, through its Washington office and elsewhere, must always support an arranged group of projects, if it is to do or progressively accomplish anything at all. If the States fall apart because of differing ambitions the organized cause cannot win. You well know that nearly all legislation in a representative government comes out of compromise by persons or by groups. The lessons of give and take, and a united push, are as old as the written pages of history. Let me add a remark—the 14 States of this organization will win their way if, one and all, they continue to pull upon the same rope. So much about fundamentals.

I must not abuse your patience with fulsome history. You know the record. The 35 years of Government leadership, and our 5 years of associated push, reveal a self-evident national accomplishment. The building of 68 dams and reservoirs, the irrigation of millions of acres, a million self-sustaining homes, a billion of new taxable wealth, the building of power plants that have aided construction, contributed to maintenance, and helped to stabilize the business of reclamation—this much has come to pass in a brief span of years. It is the inspiration of our cause—the rainbow that illumines the reclamation sky of today.

Have you seen Boulder Dam? I think it is the wonder of the age. Shall we call it the eighth wonder of the world? The seven that have been recorded in history are perhaps as spectacular, but they have had no such measure of usefulness. Boulder Dam, spreading fanlike, makes secure the living of many people who dwell in the lower half of the intermountain West. The engineering design, the solid concrete, the superpower machinery, unite in a manifold utility, a mind-impressing accomplishment that has not been surpassed in our day—the waters of a great river controlled and directed into a multiple civic and industrial usefulness for people at the river bank and hundreds of miles away. Flood control, irrigation, domestic water supply, power—here is an inspiring exhibit of what we can do with other rivers—the Missouri, the Yellowstone, the Sacramento, the San Joaquin, the Columbia—many more. The utility and national benefit of Boulder Dam can be achieved at other places. Earning revenues will pay the whole cost.

Further, and within your pleasure, I would like to review what the National Reclamation Association has been doing

during an active year. There was a generous attendance at the Spokane convention in November 1936. There was nearly a unanimous judgment that the association should have an executive secretary and an office in Washington to work for reclamation within the limitations of proven merit. There were, however, differences of opinion. The delegates had to catch trains to be at home for Thanksgiving Day. The convention adjourned. The treasurer had neither an approved budget nor money. For the moment this plight seemed serious. The spirit of reclamation, however, did not hesitate. There was a conference. An appointed volunteer committee provided a balanced budget and money so that we were soon on the way. Many of you have been advised and are therefore familiar with the work of the Washington office. May I express not a boastful, but a deliberate opinion? I think the National Reclamation Association has rendered the country, the whole country, a more valuable service in the year 1937 than any like civic organization—East or West.

In January 1937 when the Seventy-fifth Congress began its session and the usual Interior appropriations came into the picture, there was clearly in evidence the old-time group determination—first, to severely cut the reclamation money; and second, to prevent the investigation, survey, or building of new projects. It was the same ill-considered and misinformed antagonism of a number of eastern Congressmen who have continually insisted, regardless of contrary proof, that a national reclamation policy is not in keeping with really progressive agriculture throughout the whole country. This contention the Washington office tackled at once. There was continued diligent research. The findings were highly informative. You have read many of the items in the bulletins issued from Washington.

RECLAMATION STATES BUY MORE THAN THEY SELL

I believe great gains have been made in the attitude of many fair-minded Congressmen, as well as in the congressional committee situation. Through convincing research it has been revealed that we buy more than we sell—much more—that the reclamation States have not, do not, and never will produce staple agricultural commodities, such as are grown more naturally in the southern and eastern sections, sufficient to injure national agriculture. The reclamation States are not contributors to surplus crops, or to a depression of prices in agricultural commodities. On the other hand, by creating a market for the products of other States, a stabilizing

Taylor Park Dam, Uncompahgre Project, Colorado. New Lake forming above the dam.

influence is contributed to the national agricultural situation. The truth is we of the West are great contributors to merchandising and fabrication that comes out of eastern trade centers and factories. Investigation of what the reclamation States buy in textiles, tobacco, corn and hog products, automobiles, insurance premiums, and many other lines, tells the same story. In the building of Boulder Dam and Grand Coulee, 65 percent of the construction costs go to eastern fabricating points. As the first session of the Seventy-fifth Congress passes into history, I would say we have many new friends in the House of Representatives who understand the objectives of reclamation—who are ready to defend and support progressive reclamation. This has been and is the legislative battleground. The Senate has supported practical and economic reclamation in the Seventy-fifth congress, and in the one before.

At this point in the review perhaps someone will ask the question, if he is not fully informed, what about the Federal money now available? To my mind, the appropriations of the Seventy-fifth Congress for construction just ahead should be reckoned as a satisfactory outcome. The allotments measure up liberally, I think, to the expectations of the Bureau of Reclamation and this association. The Interior appropriation bill provided more than 41½ million dollars to the Reclamation Bureau, for 23 projects, in 12 States, and more than $3,300,000 for Indian Bureau projects. I did not expect more—I really did not expect as much. Add to these sums the unexpended balances reappropriated and the amount available for building in the fiscal year of 1938 reaches about 115 million dollars. There was contest over these unexpended balances. The conclusion was a reclamation victory.

The Borah-Hatch bill, plus the White measure, came through the legislative mill as a compromise enactment. It ends a general moratorium and provides for a commission to study repayment plans—to delay payments where there is an established need—a measure that should have been passed by the Seventy-fourth Congress. It had become quite evident that a continued general moratorium would destroy the present reclamation plan. What we clearly need is an adapted, flexible, repayment statute, fair to each water user, from the beginning to the end of his purchase contract, within a reasonably measured ability to pay. The commission provided in the Borah-Hatch bill can render a great service. The O'Mahoney-Greever bill, to enable the construction of small dams and reservoirs passed the Congress and was signed by the President. The deficiency bill, however, did not appropriate. There is further consideration required if we are to try out this method of reclamation. You are familiar with the Bone-Schwellenbach bill to prevent

speculation in Columbia Basin lands, the Soil Conservation Act, and the farm tenancy measure, enacted in accord with the resolutions approved by the Spokane convention of this association. The P. W. A., involving some projects where local funds are available, was extended 2 years.

Speaking inclusively, in no session that I can recall has there been more satisfactory reclamation legislation. In comparison with 1 year ago, I feel like saying, we have come out of the uncertain murky shadows of an early morning into the clear sunlight of a new day.

I hope the convening delegates share in some measure the present-day optimism of these annual remarks, but I urge as well that you study the reclamation problems still unsolved—those just ahead, and others not far around the corner. Every year introduces diversity into research and operation; how to use all the water with an evenly measured benefit, sectional, regional, and national; how to restore and build sheltering forests; how to search out supplementary water supply for existing irrigation; how to apply the benefits of drainage; how to preserve equities as we use power to assist reclamation; how to reestablish and largely increase revolving-fund revenues so that there may be uniform progress in every watershed of each reclamation State. These problems are pressing for solution—they are not even around the corner.

DEMAND FOR SUPPLEMENTARY WATER

I can only take time further to express a few opinions. The demand for supplementary water is as insistent as it was a year ago. This increasing need is even subtracting from the impetus for new construction. The forests have much to do with water supply. A few days ago I was driving along an important northwestern mountain stream. A restoration of the forest in that watershed would, I think, double the stream flow of the river. In this western country I would put every C. C. C. camp planting trees, and keep them at it. Restore the forests and the supplementary water supply question will be one-half satisfied.

POWER

The Government has 23 power plants in its reclamation set-up on 12 projects, not including Boulder Dam. The power developed has been used to aid irrigation. It has enabled the feasibility of projects. There has been varied and interesting experience from the first installation on the Salt River project in Arizona to the great Boulder Dam with its multiple operation. Power is now and then regarded as a touchy subject. Nevertheless, it is and will remain a byproduct in reclamation. There will be more installations at Grand Coulee, on the Central Valley project of California, perhaps at Fort Peck, and at other places. So there is little use in running away from the subject. Whatever this association may do or say, it should keep within the pertinent issues that pertain to reclamation, and the adequacy of legislation that shall operate in fairness to all interests and agencies that can and are willing to render useful public service.

There are advocates of a Natural Resources Board. There are those who would have more regional authorities. In connection with these proposals, great issues are involved. The Government already has operating agencies of proven ability. I am of the opinion that some sort of regional authorities could be established through legislative enactment, in fairness to all interests and agencies—including private invested capital—but it is an open question whether we are smart enough to do it. One thing is sure, time is lost if you are listening to the fellow who thinks he has mastered all the wisdom that we may wisely use in the development of our natural resources. There is one sure conclusion, this year of 1937 is a time for careful and thoughtful consideration. It is not a time for too hasty acceptance of personal conclusions.

Great Lake Mead

Blue as the beautiful sky above,
Blue as the blue in the flag we love,
Sparkling whitecaps, wind-blown spray,
Follow the speedboats all through the day,
Stupendous reservoir built by man,
Storing up water for huge Boulder Dam,
Feeding the cities, supplying their need,
Marvelous achievement—Great Lake Mead.

An inland sea in a desert gray,
Refreshing the earth in a generous way,
Where thousands of homeless, hungry souls,
May find new homes, reach long-sought goals,
Out in the open under the stars,
Gold from the end of the rainbow's bars,
Blessing a multitude, destroying greed,
Gem-of-the-Westland—Great Lake Mead.

Concentrated power, titanic might,
Increasing in magnitude day and night,
Enriching generations yet to be,
With bountiful, lasting prosperity,
A haven where seaplanes rest from their race,
Through storm-driven clouds in infinite space,
Demonstrating daily a life-giving creed,
Hail to you! Wonderful Great Lake Mead.

(Excerpt from Salt Lake Tribune, by Minnie J. Hardy)

The Government is building several big emergency irrigation projects. It should eventually get back, in addition to many smaller projects, to canyon and mountain storage—to a uniform distribution of benefits. This means that we may wisely return to an old-fashioned revolving fund with adequate revenue. Where can we get such funds? This convention may properly try to answer the question.

REVENUE RESEARCH

There have been suggestions for new revenues of various sorts, coming from the natural resources of the West—revenues resting upon advances justified by expectation of repayment or upon development contributing to the general welfare of the Nation. Because of our oil conservation policy, and diminishing land sales, revenues for the reclamation revolving fund have been dwindling away. From naval oil leases there has come into the General Treasury 40 or 50 million dollars. From private oil leases an equal amount has been paid into the reclamation fund. As a matter of revenue principle, the naval oil lease proceeds, as well as those from private oil leases, are contributed by a western resource and may rightfully be used for western development. This diversion, if corrected, would yield approximately 30 million dollars. Furthermore, it is, or will be, a fairly conceived policy, at any time, if any reserved natural resource of the West is made the basis for advances to the reclamation revolving fund under a proper reimbursable plan. The profits of Boulder Dam, if present earning schedules are maintained, might be used for the benefit of designated areas of the Colorado River Basin under the law. Repayments from the so-called emergency projects may have like consideration. The former source might ultimately be quite helpful—the latter, after a while. It will be some years before there will be any considerable come-back from such projects as Grand Coulee or the Central Valley of California, but there will be earlier returns from smaller projects. I am merely trying to open the revenue subject—to urge upon you the need for revenue research and subsequent legislative enactment, if the revolving fund, as originally conceived, is to remain the foundation upon which we are to build the future reclamation structure and carry on the conservation of the natural resources of the West.

While we advocate reclamation as a sound national policy, it is quite clear that we are coming to a stage of progressive accomplishment when the States can help themselves with their own money. At the September session of the Federal Irrigation Congress at Caldwell, Idaho, Commissioner of Reclamation Page, com-

plimented my home State, Montana, on having gone further than any other Commonwealth in spending State funds for participation in a reclamation program. The story, concisely told, has a common interest.

The Montana Legislature, in special session in December and January 1933 34 enacted a comprehensive water-conservation law. Two legislatures have appropriated $1,330,000 for a revolving fund, including operation of the department. In cooperation with the Public Works Administration, 11 projects are either on the way or are completed, at a cost of 4 million dollars, and with a benefit to 200,000 acres of land. Further public works allotments were made a few weeks ago to 5 other projects—to benefit 70,000 acres of land, at an expenditure cost of something more than $1,500,000. One other project has been approved by all public-works agencies, and is awaiting the allotment of money. The estimated cost would be a million and a quarter—the irrigation of 10,000 acres of land would be accomplished. The State of Montana has also entered upon a cooperative plan with the W. P. A. Work has already been done on nearly 100 small projects. An arrangement has recently been perfected with the W. P. A. insuring a governmental expenditure of $136,000 per month for 10 months. The State contributes $10,000 per month. Montana feels that there has been a distinct accomplishment in this State participation. Any Western State can do likewise.

Now I am sure you are ready to hear the end of these remarks. You will join with me in reassuring satisfaction because reclamation has been a successful enterprise for 35 years. No other western business has met its obligations as well, in the repayment of construction costs, meeting the obligations of operation, maintenance and water rentals. As this annual convention begins its work, I am firm in a renewing confidence that reclamation can make a new West—a bountiful dwelling place—using the natural resources of a pioneer empire. Prosperity for a new generation will be measured in a well-directed effort—a forceful government leadership, an increasing State contribution—the support of contented people who use the water. The National Reclamation Association, I am sure, can help in a manifold service. I have the faith that there will appear a continually broadening opportunity. Ultimately, reclamation will take its rightful place in a national public works program.

PRESIDENT ROOSEVELT ENDORSES RECLAMATION

President Roosevelt spoke to the point on his recent western trip. I felt a great confidence and a new enthusiasm as I read the news reports. Let me recall what the President said:

At Cheyenne:

> I am very firmly convinced that the people of the Nation have more and more a national point of view. I believe it will be written in history as a great accomplishment of these years we are living in now the welding together of the people of the United States.

At Casper:

> We are not only acting, but thinking, in national terms.

At Bonneville:

> The more we study the water resources of the Nation, the more we accept the fact that their use is a matter of national concern and that our plans for their use—our line of thinking—must include great regions as well as narrower localities.

At Fort Peck:

> We are going to do many things for the preservation of water in the dry area. We are going to take people off poor land and put them on good land.

This has been the reclamation doctrine from Theodore Roosevelt to Franklin D. Roosevelt. This will be the catechism as we go on.

The forests, the water, and the land are the resources of the Nation that last forever in every State—east and west. The control of flood waters, the storage and use of water to assist production—is a challenge to business, to the States, and to the National Government. If our natural resources really become a national problem, in just a little while there will be a greater western America—this land that we purchased for a song.

Rutledge Smith Visits Boulder Dam

Rutledge Smith consulting engineer of Nashville, Tenn., an ardent friend and admirer of Dr. Elwood Mead, late Commissioner of Reclamation, on a recent extended western trip accompanied by Mrs. Smith visited Boulder Dam and was shown the details of that great engineering project. Mr. Smith was unsparing in his commendation of the engineering knowledge of the officials and of their courtesy to him and Mrs. Smith as he visited Observation Point on the Nevada side overlooking Lake Mead, and as he affectionately embraced the memorial plaque erected in honor of Dr. Mead.

Mr. Smith has always interested himself in the operations of the Bureau of Reclamation. He was active during the period when under the authority of Congress the Bureau investigated the opportunities for planned group settlements in the Southeastern States.

Lands not Subject to Bond Issue Lien

In 1922 the United States acquired land within the Anderson cottonwood irrigation district in California. The district levied assessments upon this land subsequent to its acquisition by the United States and the United States brought suit against the district and certain of its officers to cancel the assessments levied and to restrain future assessments.

The United States District Court for the Northern District of California on June 26, 1937, rendered a decision, 19 Fed. Sup. 740, holding that the bonds of the district are not secured by the property of individuals within the district but are to be paid by a revenue derived from an annual assessment upon the lands of the district. In interpreting the irrigation district act of California, the court held that the clause in the act that "All the land within the district shall be and remain liable to be assessed for such payments" does not establish a lien against the property; that the California Legislature delegated to the district the power to levy yearly assessments upon the land, but the power delegated by the State must be measured by the power of the State; that neither the State nor any of its instrumentalities may lawfully tax Federal property, and that the attempt of the district to tax the lands of the United States is unlawful, and future assessments must be restrained.

Message of Commissioner Page to Washington Irrigation Institute

"I am sorry that I shall not be able to attend the silver jubilee meeting of the Washington Irrigation Institute at Yakima, November 18 and 19. I hope you have a good meeting and in the name of the Bureau of Reclamation I wish to thank the institute and its members for the friendly and helpful interest taken in our work and problems.

"It is time for all of us to realize that the Federal reclamation policy, founded as it is on the principle of repayment of construction costs by those who benefit, is in the hands of the water users on the Federal projects. I am convinced that the Government will continue to build new irrigation works just so long as it can be said honestly that there is reasonable prospect for repayment of the capital investment. There is little, if any, sentiment against discriminating relief for projects actually in need, but blanket moratoria on repayment charges affecting prosperous and stricken projects alike hold a real danger to the continuation of the Federal reclamation policy.

"Federal reclamation projects are not constructed for the purpose of enriching real estate operators and a handful of landowners who may be fortunate enough to hold lands within the irrigable areas of projects chosen for construction. If they were, there is not an honest citizen who would rise to their defense.

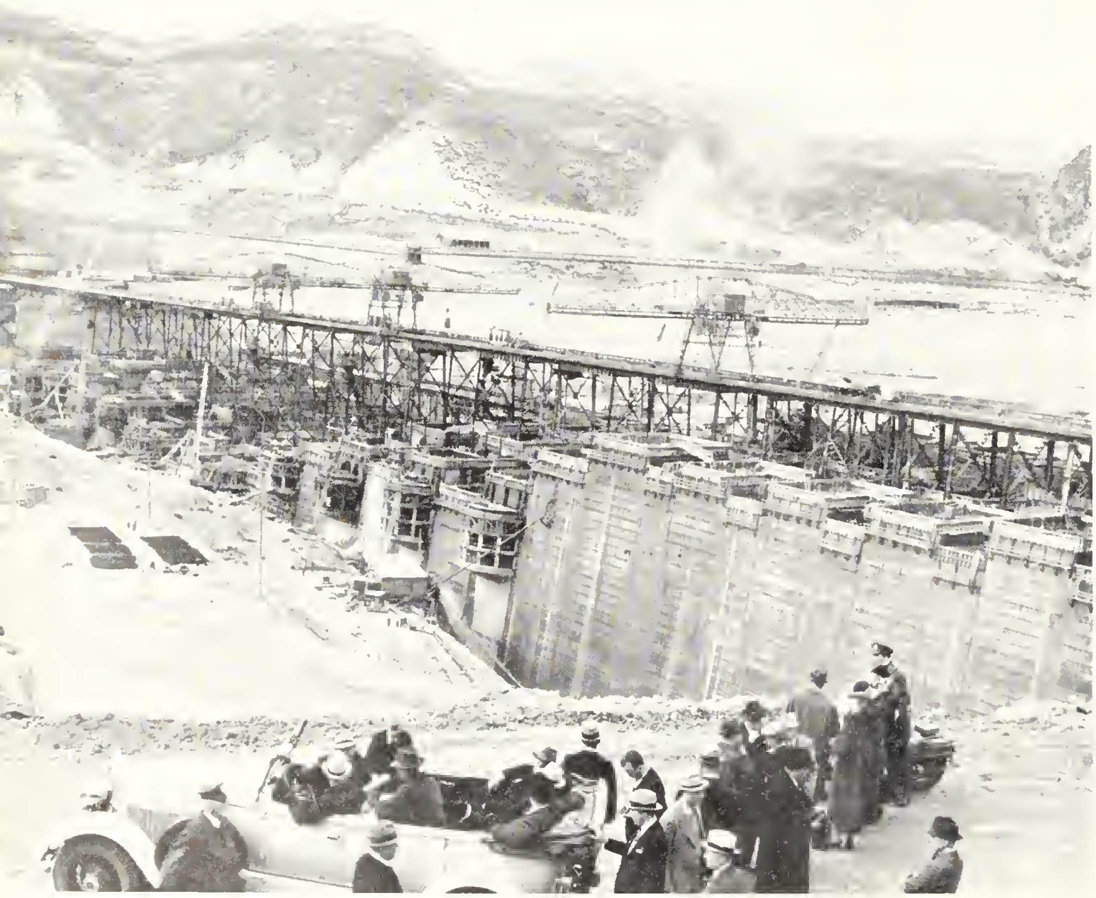
"The fundamental purpose of this program of improvement is and always will be to provide new and better homes where American families can earn for themselves an American standard of living.

"Speculation in project lands, therefore, has been stamped out. Since 1926 the lands of all new projects have been appraised by the Government and disposal has been required of holdings in excess of a single-family farm unit in accordance with the appraisals. These appraisals have been fair, but they have been based on the value of acreages within the project areas without any regard to potential increases in values which might result from provision of a water supply by construction of project works. It is sound theory that individuals should not be permitted to profiteer because of Government expenditures.

"This is significant to the State of Washington at this time because of the work underway on the great Columbia Basin project, which will irrigate 1,200,000 acres of lands in your State. An act to prevent speculation has been enacted as a part of the basic law under which the Columbia Basin project is being constructed. I am glad that this act was sponsored by Washington's representatives in the Congress, because there were some Doubting Thomases who feared selfish interests would sway the State to oppose such action.

"The fine cooperation by the officials of your State and generally by your citizens since the enactment of the antispeculation act in efforts to meet its terms and make it effective, is most encouraging. This contains bright promise that the Columbia Basin project will be signally successful with all that its success will mean to the State in growth and development.

"There is a marked need for new lands, adequately watered and properly protected, to provide new homes for those who have been forced by drought or by exhaustion of older lands in other areas to abandon their homes. The Bureau of Reclamation must provide these new opportunities, and it must provide them in such a manner that the settler will have a fair chance of achieving success."



The Presidential car stopped on the river above the dam for a general view of the construction. President Roosevelt said: "It is so much bigger than anything that has been tried before, that there is no comparison. We look forward not only to the great good this will do in the development of power, but also in the development of homes, the bringing in of thousands of acres of new lands for future Americans."

A celebration was held in Reno, Nev., on September 10 and 11 for the express purpose of dedicating two new bridges, both bridges having been officially accepted with the exception of the installation of a transformer in connection with the Sierra Street bridge lighting equipment. These bridges have greatly benefited traffic conditions.

Cotton is opening rapidly on the Rio Grande project and ginning is well under way. In the El Paso Valley there were 9,344 bales of cotton ginned as compared with 4,009 bales for the same period last year.

Notes for Contractors

Specifications No.	Project	Bids opened	Work or material	Low bidder		Bid	Terms	Contract awarded
				Name	Address			
969-D	All-American Canal, Ariz.-Calif.	Sept. 16	Three 60,000 pound capacity, double-drum, motor-driven, radial-gate hoists for Gila Valley canal headworks, Imperial Dam.	Valley Iron Works	Yakima, Wash.	$9,265.00	Discount 5 percent	Sept. 23
966-D	Owyhee, Oreg.-Idaho.	Sept. 3	Structures, South canal lateral S. C. 5.7, station 195 to end, and sublaterals Succor Creek division.	Fife & Co	Nyssa, Oreg	21,166.50		Sept. 25
962-D	do	Sept. 1	Structures, South canal lateral S. C. 5.7, station 0 to station 195 and sublaterals Succor Creek division.	Henry L. Horn	do	22,551.00		Sept. 22
965-D	Kendrick, Wyo.	Sept. 3	Preparation and stock piling of concrete aggregates.	Mountain States Co	Billings, Mont	13,375.00		Do
745	Boise-Payette, Idaho.	Sept. 14	Earthwork and structures, Black Canyon canal, station 1250 to station 1520.	J. A. Terteling & Sons	Boise, Idaho	71,768.00		Oct. 1
753	Kendrick, Wyo.	Sept. 17	Trash rack metal work for outlet works and power penstocks at Seminoe Dam.	Silver Roberts Iron Works, Inc	Denver, Colo	[1] 21,600.00	F. o. b. Parco	Oct. 5
				St. Louis Structural Steel Co.	East St. Louis, Ill.	[2] 28,156.00	Discount ½ percent	Do
				do	do	[3] 5,177.00	do	Do
				Spuck Iron & Foundry Co.	St. Louis, Mo	[4] 2,350.00	do	Sept. 28
967-D	Riverton, Wyo	Sept. 14	Preparation of concrete aggregates.	M. J. Gilpatrick	Riverton, Wyo	11,830.00		Oct. 5
959-D	Boulder Canyon, Ariz.-Nev.	Sept. 9	Insulated cable for Boulder power plant.	Eagle Electric Supply Co., Inc.	Boston, Mass.	19,966.40	F. o. b. Boulder City	Oct. 9
970-D	do	Sept. 17	Transmission towers and switchyard structures for Pioche transformer circuit and switch station at Boulder switchyard.	Bethlehem Steel Co	Bethlehem, Pa	12,700.00	do	Do.
971-D	Owyhee, Oreg.-Idaho.	do	2,300-volt switching equipment.	Roller-Smith Co	do	[1] 5,202.00		Oct. 12
			Four 1,000 kv. a., single-phase, 60-cycle, 66,000 to 2,300 volt transformers.	Pennsylvania Transformer Co.	Pittsburgh, Pa	[2] 16,465.00	F. o. b. Dunaway, Oreg	Do.
			One 3-pole, 69,000-volt lightning arrester.	General Electric Co	Schenectady, N. Y.	[3] 1,874.16		Do
46,988-B	Colorado River, Tex.	Sept. 9	45,000 barrels of Portland cement in paper bags.	Republic Portland Cement Co.	San Antonio, Tex.	104,850.00	F. o. b. Rutledge, discount 10 cents per barrel.	Oct. 7
744	All-American Canal, Ariz.-Calif.	Sept. 2	Earth lining, stations 51+50 to 691+46.	A. S. Vinnell Co	Alhambra, Calif.	147,462.00		Oct. 9
746	Riverton, Wyo	Sept. 20	Structures on Pilot canal, stations 1364 to 1570 and highway bridge at station 846.	Otis Williams & Co	Vale, Oreg	55,800.80		Oct. 5
748	Yakima-Roza, Wash.	Sept. 22	Earthwork, canal lining and structures, Yakima Ridge canal, stations 1120 to 1595.	Guthrie, McDougall Co. and Mark C. Walker & Son Co.	Portland, Oreg., and Omaha, Nebr	186,645.90		Oct. 12
751	Boise-Payette, Idaho.	Sept. 20	Earthwork, canal lining and structures, Black Canyon canal, stations 157 to 477+25.	Haas, Doughty & Jones and Marshall & Stacy.	San Francisco, Calif.	174,333.90		Oct. 11
754	Kendrick, Wyo.	Oct. 1	Three motor-driven gate hoists for Alcova spillway.	Koppers Co. (Western Gas Division).	Fort Wayne Ind.	95,000.00	F. o. b. Fort Wayne	Oct. 18
749	Boulder Canyon, Ariz.-Nev.	Oct. 4	Two 168-inch butterfly valves for Boulder power plant.	Hardie-Tynes Mfg. Co.	Birmingham, Ala	298,960.00	F. o. b. Birmingham	Oct. 20
983-D	Kendrick, Wyo.	Oct. 8	1,000 barrels of modified Portland cement in bulk for Seminoe Dam.	Monolith Portland Midwest Co	Denver, Colo	9,632.00	F. o. b. Parco	Oct. 18
972-D	Gila, Ariz	Oct. 1	Diversion and sluice gates for Gila Valley Canal desilting works.	Pacific Iron & Steel Co. Ltd	Los Angeles, Calif.	12,465.00	F. o. b. Los Angeles	Do.
968-D	Owyhee, Oreg.-Idaho.	Sept. 15	Three motor-driven pumping units for Owyhee Ditch pumping plant.	Bingham Pump Co. Inc.	Portland, Oreg	28,206.00	F. o. b. Portland	Oct. 22
960-D	Boulder Canyon, Ariz.-Nev.	Sept. 7	Two 230 kv., 3-pole disconnecting switches and two 230-kv., 3-phase, outdoor-type lightning arresters.	Pacific Electric Co.	San Francisco, Calif	16,353.80	F. o. b. Boulder City	Oct. 18
				General Electric Co	Schenectady, N. Y.	[6] 17,160.00	do	Oct. 15
975-D	Kendrick, Wyo	Oct. 8	Three 120-inch diameter penstocks and two 72-inch diameter outlet pipes for Seminoe Dam and power plant.	Treadwell Construction Co.	Midland, Pa	[1] 15,156.00 [2] 7,020.00	F. o. b. Midland	Oct. 23 Do
974-D	All-American Canal, Ariz.-Calif.	Oct. 6	One gasoline-engine generator unit for installation at Imperial Dam.	Maurice W. Brainard	Los Angeles, Calif.	2,950.00	F. o. b. Los Angeles	Oct. 23

[1] Item 1. [2] Item 2. [3] Item 3. [4] Item 4. [5] Schedule 1. [6] Schedule 2.

AT the Malheur County Fair, held early in September, the Vale-Owyhee Land Settlement Association sponsored exhibits of products from new lands not more than 2 years out of sagebrush, and many prizes were won in competition with exhibits from the old lands.

THE motion-picture film, "Reclamation and the C. C. C.," is now available in three reels, sound, 16 and 35 millimeters, with a four-reel silent version to be released shortly.

THIS fall new potato cellars on the Klamath project have increased their storage facilities about 250,000 sacks, and project storage should be ample for this year's crop.

LOWER Yakima Valley ranchers expect to harvest in excess of $100,000 worth of grapes this season, selling them for as high as $45 a ton, the highest price in more than 10 years, and about $15 a ton more than last year's price. The demand is far greater than the supply.

AN unofficial estimate by the postmaster places the present population of the city of Yakima at 29,058, an increase of about 7,000 over the 1930 census. The figure is based upon the number of families living within the city limits as determined by city mail carriers.

IN order to get a true picture of unemployment in the United States a national census is under way. After returns are in it will take several months to tabulate them.

Hon. Charles West, Under-Secretary of the Interior, was a recent official visitor on the Rio Grande project.

Commissioner John C. Page attended the Sixth Annual Convention of the National Reclamation Association at Casper, Wyoming, October 12–14, and while there held a series of conferences with delegations from many States on local reclamation problems.

Other Bureau officers who were in attendance at the meeting included Raymond F. Walter, chief engineer, who addressed the convention on progress of construction during the year; Harry W. Bashore, construction engineer, Kendrick project; B. E. Stoutemeyer, district counsel, Portland, Oreg.; J. S. Moore, superintendent, Yakima project; C. F. Gleason, superintendent of power, Guernsey, Wyo.; H. D. Comstock, superintendent, Riverton project; William E. Warne, director of information, Washington, D. C.; and Phil Dickinson, assistant director of information, Central Valley project.

Mr. Page, on the trip which took him to Casper, also spent several days at Denver, Colo., and made inspection trips to New Mexico and Utah.

L. N. McClellan, Chief Electrical Engineer, arrived in Washington from Denver on November 1. Mr. McClellan was called to Washington to take part in the conference on requested changes in Boulder Dam contracts for power.

Porter J. Preston, in charge of the Colorado River investigations, is spending a short time in the Washington office, where he was called to attend a conference in the Secretary's office on November 12 on the Colorado Big Thompson project.

L. H. Mitchell, field supervisor in charge of District No. 1, returned to Washington on November 1, having spent 6 months with project leaders in his territory giving aid and direction concerning weed eradication, putting water to its intended use, introducing plants best fitted for marginal lands and soil improving. For 2 months he was on the Frenchtown project in charge of construction, operation and maintenance and giving the farmers there first instructions on the proper methods of irrigating.

S. E. Hutton, assistant director of information, with headquarters at Coulee Dam, Wash., is spending some time in the Washington office in connection with the preparation of publicity matter on the Columbia Basin project.

Darrel Greenwell, Administrator, and H. C. Jesson, Chief Engineer, Works Progress Administration; and T. H. Humpherys, State engineer, were shown over the Moon Lake project the latter part of September by Associate Engineer L. R. Dunkley. Considerable interest in the construction features of the Midview Dam and Dike was displayed by the visitors.

Gov. Leslie A. Miller, State Engineer John D. Quinn, L. F. Thorton, Percy Jenkins, and W. F. Wilkerson, members of the State water conservation board, visited the Heart Mountain division of the Shoshone project during September.

Roy McNeil, inspector from the All-American canal project; William Sha, chief clerk of the Colorado River project; and H. Lloyd Miller, a director of the National Reclamation Association, were among the September visitors to the Orland project.

C. A. Lyman, inspector for the Bureau, called at the Klamath project office twice during the month of September. While on the project Mr. Lyman assisted and advised the secretary of the Klamath irrigation district in setting up individual accounts for the district water users.

J. J. Tafoya, engineer, International Boundary Commission of Mexico, with 10 seniors of the class in Civil Engineering of Mexico University, visited the Rio Grande Project and Caballo Dam early in September.

J. R. Iakisch, construction engineer, arrived on the Klamath project early in September, having been assigned to the project to make an investigation and report on the possibilities of further development of the Tule Lake area.

The following appointments were recently authorized by the Secretary of the Interior:

Washington office:

- Francis J. Olsen, clerk, Chief Clerk's division, by transfer from the National Park Service.

Denver office:

- Sumner B. Foster, assistant engineer, vice Joseph G. Turner, transferred.

The following transfers were recently authorized by the Secretary of the Interior:

To Denver:

- Henry W. Johnson, field representative, Field Service, from chief clerk, Ogden River project.

To Boulder Canyon project:

- Charles R. Double, junior engineer, from the Denver office.
- Russell D. Palmer, junior engineer, from the Denver office, to cooperative investigations, California Institute of Technology, Pasadena.
- Donald P. Barnes, engineer, from associate engineer, Denver office.

To Central Valley project (Friant Dam):

- Walter E. Seyfarth, associate engineer, Friant Dam, from the Alamogordo Dam, Fort Sumner, N. Mex.
- Marshall Young, assistant engineer, from Ogden River project.

To Boise investigations:

- Henry J. Tebow, assistant engineer, from the Denver office.

The following resignations were recently accepted by the Secretary of the Interior:

Denver office:

- Thor Bjornstad, assistant engineer, to accept a position with the State highway department at Olympia, Wash.
- Russell A. Meador, assistant engineering draftsman, to accept employment with a manufacturing concern in Denver.
- Millard V. Barton, junior engineer, to accept a position on the teaching staff at Cornell University, Ithaca, N. Y.
- Arthur P. Gardiner, junior engineer, to go with the Washington State Highway Commission, Seattle, Wash.
- Archibald W. Adkins, associate engineer, to accept a position as instructor in applied mechanics at the Massachusetts Institute of Technology.
- Dana D. Sherrill, junior engineer, to become instructor in department of mechanical engineering, University of Iowa.
- William L. Ziegler, assistant engineer to accept employment with the Bethlehem Steel Co., Bethlehem, Pa.

Columbia Basin project:

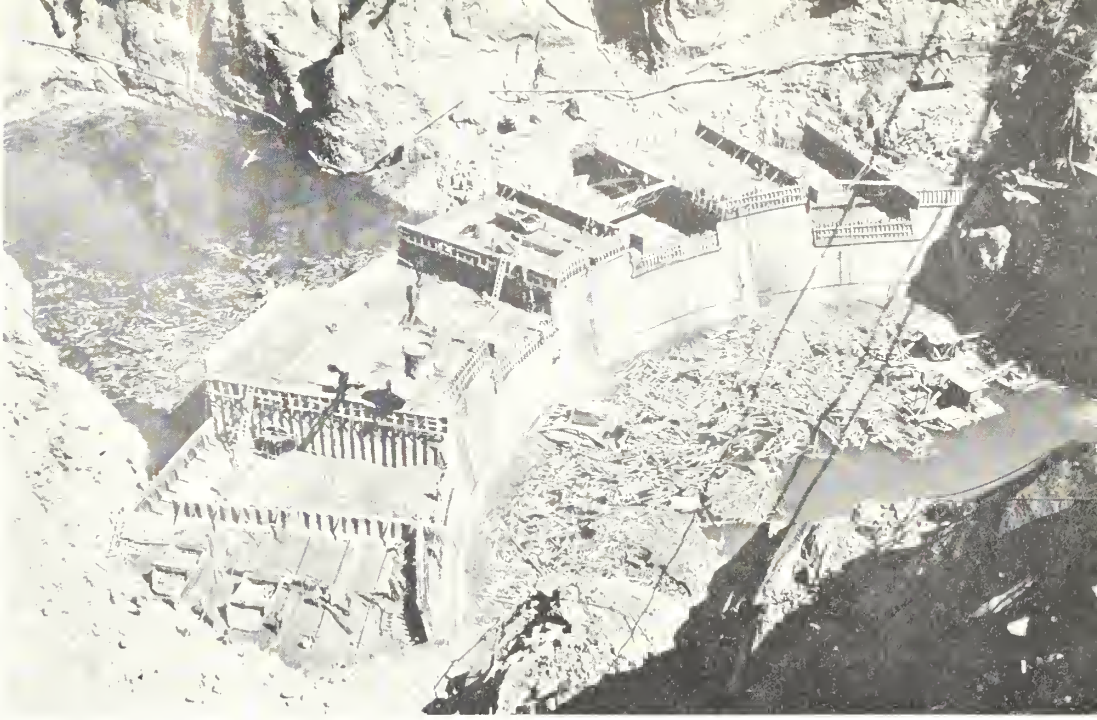
- William H. Irwin, geologist, to take up work as assistant professor in department of geology, University of North Carolina.

ABOUT 2,000 men and women are now working in fruit canneries in Yakima.

THE first issue of The Las Cruces Sun, a daily newspaper published at Las Cruces, N. Mex. (Rio Grande project), appeared on September 23.

RED clover seed is being harvested on the Owyhee project, Oregon-Idaho. With excellent yields and prices, this crop is proving to be a big cash crop this year on both old and new lands. Gross returns exceeding $100 an acre on new land, and $175 on old land have been reported for some of the best fields. The estimated area of red clover in Malheur County this year is 6,000 acres.

FOLLOWING the announcement by Secretary of the Interior Ickes of the opening to entry of 69 public land farm units on the Tule Lake division of the Klamath project, Oregon-California, 2,100 requests for farm application blanks were received at the project to and including September 30. The date of opening was October 25.



Parker Dam Project, California. Parker Dam viewed from top of California abutment excavation.

National Reclamation Association Meets at Casper, Wyo.

ON OCTOBER 12-14 the National Reclamation Association meeting in annual convention at Casper, Wyo., was attended by many national authorities, leaders of thought, and men of action. Among these were the following:

United States Senator Alva B. Adams, of Colorado, Chairman of Senate Committee on Public Lands and Surveys; member of Irrigation and Reclamation Committee, and holding other important committee assignments;

John C. Page, Commissioner of Reclamation, Washington, D. C;

O. S. Warden, president of the National Reclamation Association, who is a member of Montana's State Water Conservation Board, past president of the American Association of State Highway Officials, and publisher of the Great Falls (Mont.) Tribune;

Joel David Wolfsohn, executive secretary of the President's National Power Policy Committee, Washington, D. C.;

Arthur J. Weaver, ex-Governor of Nebraska, for many years president of the Missouri Valley Navigation Association, and now president of the powerful Mississippi Valley Association, the principal factor in the 30 years of development on the Mississippi River, and now one of the spearhead organizations for an adequate national flood control program—a man who knows the West;

Marshall N. Dana, of Portland, Oreg., associate editor of the Oregon Journal, first president of the National Reclamation Association, serving 4 years, and during whose administration Federal irrigation construction jumped from $10,000,000 to $50,000,000 per year;

F. E. Huddleston, of Billings, Mont., president of the Montana Sugar Beet Growers' Association;

Gov. Henry H. Blood, of Utah, who comes from the cradle State of western irrigation;

Dr. W. W. McLaughlin, of Berkeley, Calif., Chief of the Division of the Federal Bureau of Agricultural Economics and in charge of the Great Plains "dust bowl" program for the Federal Government;

Maj. W. DuB. Brookings, Washington, D. C., manager of the natural resources production department of the Chamber of Commerce of the United States;

F. R. Carpenter, of Washington, D. C., Director of Grazing for the Department of the Interior, who has charge of the enforcement of the Taylor Grazing Act;

R. F. Walter, of Denver, Colo., chief engineer, Bureau of Reclamation;

A. D. Wathen, of Washington, D. C., Director of Irrigation, Indian Service.

Hon. Leslie A. Miller, Governor of Wyoming;

Hon. Harry H. Schwartz, junior United States Senator from Wyoming;

Hon. Paul R. Greever, Congressman from Wyoming;

Hon. Compton I. White, of Idaho, Chairman of the Irrigation Committee of the House of Representatives.

President Warden addressed the convention at the opening session. His address is carried in full in this issue of the ERA.

Among other addresses the following are of particular interest to our readers:

Commissioner of Reclamation John C. Page, Progress and Problems of Reclamation;

F. R. Carpenter, Irrigation and Range Use;

R. F. Walter, Reclamation Construction and Future Plans;

Hon. Arthur J. Weaver, Full Utilization of the Waters of the West;

Marshall N. Dana, Reclamation and the Home;

W. W. McLaughlin, The Rehabilitation of the Drouth Area and Water Conservation;

Maj. W. DuB. Brookings, Our Natural Resources and Reclamation;

Joel David Wolfsohn, The Regional Conservation Authority Proposals;

Hon. Henry H. Blood, History and Development of Reclamation in the West;

C. L. Corkins, Noxious Weed Control.

About 500 persons, including delegates to the convention and residents of Casper, visited Alcova Dam, of the Kendrick project, on the afternoon of October 12. While a supper was being served in the spillway excavation, Mr. Bashore gave the crowd a history of the North Platte River and the Kendrick project. This outing was one of the high points of the convention.

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Outlining the power-producing value of head-water storage on the Columbia River, map and chart, C. I. Grimm. Western Construction News, September 1937, vol. 12, no. 9, pp. 337–340.

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Passage of turbid water through Lake Mead and discussion of Elephant Butte Reservoir by Commissioner Page and others. Proc. Am. Soc. C. E., September 1937, vol. 63, no. 7, pp. 1405–1421.
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Drought again threatens Montana industry (absence of water supply—importing 40,000 kw. from Washington). Electrial West, September 1937, vol. 79, no. 3, pp. 72–73.

Newberger, Richard L.:
Western Deserts made to bloom, illus. N. Y. Times, Sunday, Sept. 12, 1937, sec. 8, pp. 7 and 26.

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Passage of turbid water through Lake Mead, discussion. Proc. Am. Soc. C. E., September 1937, vol. 63, no. 7, pp. 1411–1413.
Repayments only hope of financing extension of Reclamation projects, Federal Irrigation Congress, Caldwell, Idaho. Southwest Builder and Contractor, September 24, 1937, vol. 90, no. 13, pp. 10–11.

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Computation of earth pressures against walls with earth having cohesion. Br. Bror Fellenius, C. E., (Trans. from Swedish), Tech. Memo. no. 559, Sept. 7, 1937. Price $2.50, Chief Engineer, Bureau of Reclamation, Denver, Colo., 32 pp. and charts.

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Asphaltic oil used on canal banks to prevent movement of Dune Sand, illus. Western Construction News, September 1937, vol. 12, no. 9, pp. 332–333.

Venturi Meter:
The 50th year of a great invention, Venturi Meter of Clemens Herschel, illus. C. G. Richardson, Water Works Engineering, Sept. 15, 1937, vol. 90, no. 19, pp. 1326–29, 1382.

Wharton, Mel.:
Parker Dam, illus. Explosives Engineer, September 1937, vol. 15, no. 9, pp. 263–274.

Williams, C. P.:
Reclamation as an aid to Industrial and Agricultural Balance. Proc. Am. Soc. C. E., September 1937, vol. 63, no. 7, pp. 1379–1382.

Yuma Valley Antinoxious Weed Board Reports Progress in Eradicating Johnson Grass

CONSIDERABLE progress in the eradication of perennial Johnson grass has been made in Yuma Valley, according to a weekly article of the antinoxious weed board appearing recently in the Yuma Daily Sun.

The encouraging results of the work of Yuma Valley farmers in eradicating Johnson grass emphasize the fact that killing weeds is a task of the individual landowner and requires good management and elbow grease.

"The rootstocks of Johnson grass", the weed board points out, "while they remain undisturbed, are the foundation of its perpetual life. Added to that is the seed which matures in half a season, making the plant the fastest increasing vegetation with which the Yuma farmers have to contend."

The board emphasizes the importance of preventing Johnson grass from seeding and the necessity of destroying the underground rootstocks.

The several methods and persistent work of James McLay, an old-time practical farmer of the valley, were recently observed by the board directors. In eradicating certain plots of Johnson grass Mr. McLay killed the rootstocks by scalding. This method, according to the weed board, is often practical "if the growth is on a bordered field capable of being flooded, preferably in hot weather, and all the underground growth is scalded, rotted, and killed." Farmer McLay has also followed the method of spraying with oil to rid his laterals of Johnson grass and horsenettle. Following up his work consistently, whenever young plants appeared from seed that had hitherto escaped, he applied oil to these scattering plants with a hand sprayer. Laterals on his farm are now clear of both Johnson grass and horsenettle.

Commenting on the importance of faithful follow-up work in eradicating Johnson grass, the board maintains that "when the main body of infestation is well under control there will always be incipient reappearances that need watching. One of the most careful farmers of the valley in the past year found and destroyed 25 such examples in what he called clean alfalfa."

The board thanks all who are cooperating in the county-wide program to eradicate noxious weeds in Yuma Valley.

HERBERT PECKHAM, of Wilder, Boise Project, Idaho, reported a yield of 863 sacks of onions per acre on 17 acres. President Roosevelt was shown this field on his recent trip through the Boise Valley.

U. S. GOVERNMENT PRINTING OFFICE: 1937

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR
THEODORE A. WALTERS, FIRST ASSISTANT SECRETARY, in charge of reclamation

John C. Page, Commissioner — **Roy B. Williams**, Assistant Commissioner

J. Kennard Cheadle, Chief Counsel and Assistant to Commissioner; Miss Mae A. Schnurr, Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr.; Wesley R. Nelson, Chief, Engineering Division; P. I. Taylor, Assistant Chief; A. R. Golzé, Supervising Engineer, C. C. C. Division; William F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief, Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief. Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, and Henry W. Johnson, Field Representatives; L. S. Davis, Engineer, C. C. C. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz	Leo J. Foster	Constr. engr	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Buffalo Rapids	Glendive, Mont	Paul A. Jones	do	Edwin M. Bean	W. J. Burke	Billings, Mont.
Burnt River	Unity, Oreg	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Fort Sumner, N. Mex	Wilfred W. Baker	Constr. engr		do	Do.
Central Valley	Sacramento, Calif	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex	H. P. Bunger	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin	Coulee Dam, Wash	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Gila	Yuma, Ariz	Leo J. Foster	do		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah
Humboldt	Lovelock, Nev	Stanley R. Marcau	Resident engr.[2]	George B. Snow	do	Do.
Kendrick	Casper, Wyo	H. W. Bashore	Constr. engr	C. M. Voyen	W. J. Burke	Billings, Mont.
Klamath	Klamath Falls, Oreg	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont	H. V. Hubbell	Constr. engr	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Superintendent	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Orland	Orland, Calif	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif	E. A. Moritz	do	George W. Lyle	R. J. Coffey	Los Angeles, Calif.
Pine River (Vallecito Dam)	Bayfield, Colo	Charles A. Burns	do	John S. Martin	J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex	L. R. Fiock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex	S. F. Crecelius	Constr. engr	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Bull Lake Dam	do	Arthur P. Smyth	Resident engr		do	Do.
Salt River	Phoenix, Ariz	E. C. Koppen	Constr. engr	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo	Walter F. Kemp	Constr. engr	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont	A. W. Walker	Superintendent		do	Do.
Truckee River Storage	Reno, Nev	Charles S. Hale	Constr. engr.[2]	George B. Snow	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg	C. L. Tice	Reservoir supt		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repair to canals	Montrose, Colo	C. B. Elliott	Constr. engr	do	do	Do.
Upper Snake River Storage [3]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza division	do	Charles E. Crownover	Constr. engr	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

[1] Boulder Canyon. [2] Acting [3] Island Park and Grassy Lake Dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division) [1]	Lower Powder River irrigation district	Baker, Oreg	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root [4]	Bitter Root irrigation district	Hamilton, Mont	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton
Boise [1]	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Do	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M. Watson	Caldwell.
Grand Valley, Orchard Mesa [3]	Orchard Mesa irrigation district	Grand Jctn., Colo	C. W. Tharp	do	C. J. McCormich	Grand Jctn.
Huntley [4]	Huntley irrigation district	Ballantine, Mont	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum [3]	South Cache W. U. A	Hyrum, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley [1]	Langell Valley irrigation district	Bonanza, Oreg	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsefly [1]	Horsefly irrigation district	do	Henry Schmor, Jr	President	Dorothy Eyers	Do.
Lower Yellowstone [4]	Board of Control	Sidney, Mont	Axel Persson	Manager	Axel Persson	Sidney.
Milk River: Chinook division [4]	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity [1]	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping [1]	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding [1]	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands [3]	Truckee-Carson irrigation district	Fallon, Nev	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division [4]	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division [4]	Gering-Fort Laramie irrigation district	Gering, Nebr	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
Do.[4]	Goshen irrigation district	Torrington, Wyo	Bert L. Adams	do	Mary E. Harrach	Torrington.
Northport division [4]	Northport irrigation district	Northport, Nebr	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan [1]	Okanogan irrigation district	Okanogan, Wash	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan
Salt Lake Basin (Echo Res.) [3]	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	do	D. D. Harris	Layton.
Salt River [2]	Salt River Valley W. U. A	Phoenix, Ariz	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland division [4]	Shoshone irrigation district	Powell, Wyo	M. P. McLaughlin	Irri. superintendent	Geo. W. Atkins	Powell.
Frannie division [4]	Deaver irrigation district	Deaver, Wyo	Floyd Lucas	Superintendent	Lee N. Richards	Deaver.
Strawberry Valley [3]	Strawberry Water Users' Assn	Payson, Utah	S. W. Grotegut	Manager	E. G. Breeze	Payson.
Sun River: Fort Shaw division [4]	Fort Shaw irrigation district	Fort Shaw, Mont	E. J. Gregory	do	E. J. Gregory	Fort Shaw.
Greenfields division [4]	Greenfields irrigation district	Fairfield, Mont	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division [1]	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	Enos D. Martin	Hermiston.
West division [1]	West Extension irrigation district	Irrigon, Oreg	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre [3]	Uncompahgre Valley W. U. A	Montrose, Colo	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose.
Yakima, Kittitas division [1]	Kittitas reclamation district	Ellensburg, Wash	V. W. Russell	Manager	G. L. Sterling	Ellensburg.

[1] B. E. Stoutemyer, district counsel, Portland, Oreg. [2] R. J. Coffey, district counsel, Los Angeles, Calif. [3] J. R. Alexander, district counsel, Salt Lake City, Utah. [4] W. J. Burke, district counsel, Billings, Mont.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo	P. J. Preston	Senior engineer.
Colorado-Big Thompson	Denver, Colo	Mills E. Bunger	Engineer.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Rio Grande Basin	Denver, Colo	Wm. G. Sloan	Do.
Western Slope (Colo.)	do	Frank C. Merriell	Do.
Black Hills	do	R. E. Kennedy	Assistant Engineer.
Eastern Slope (Colo.)	do	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do.
Grande Ronde	La Grande, Oreg	C. C. Fisher	Do.

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget. SALLIE A. B. COE, *Editor.*

THE RECLAMATION ERA

DECEMBER 1937

REPAYMENT COMMISSION

IN ACCORDANCE with the authorization by Congress to devise a more equitable method by which water users on Indian and Federal reclamation projects shall repay the cost of construction of irrigation works built by the Government, the Secretary of the Interior has appointed the following Commission:

Dr. Charles A. Lory, chairman.

Mr. William R. Wallace.

Mr. George T. Cochran.

Goodrich W. Lineweaver has been appointed executive secretary of the Repayment Commission.

George O. Sanford, General Supervisor of Operation and Maintenance, Bureau of Reclamation, will accompany the Commission on its tour of the projects.

The act authorizing the Commission required that all three members should have an intimate knowledge of irrigation farming but should not be employees of the Bureau of Reclamation or the Bureau of Indian Affairs of the Department of the Interior; and that they should have no direct financial interest in the matters coming before the Commission.

Dr. Lory, of Fort Collins, Colo., has been president of the Colorado State College since 1902 and is an authority on irrigation matters.

Mr. Wallace, of Salt Lake City, Utah, for several years was the chairman of the Utah Water Storage Commission.

Mr. Cochran, of La Grande, Oreg., is an attorney. He served for 12 years as State water superintendent and is an authority on water law.

The act authorizes the Repayment Commission to visit, hold hearings, and study the Federal and Indian irrigation projects and to recommend to the Secretary of the Interior, where conditions warrant such action, postponement of all or any part of the construction repayments due in 1937; and to devise and recommend for the consideration of Congress a new permanent repayment method. The present law for repayments is inflexible, requiring the water users to pay specified sums each year of the repayment period without regard to unusual conditions, fluctuating prices, etc.

The initial meeting of the Commission was held in Denver on November 30. The itinerary for visits to the projects covers a swing through the Northern States, with the North Platte and Belle Fourche projects first on the list, then turning south to cover the southern projects. Twenty-four hearings are scheduled.

Headquarters will be maintained at Denver, where irrigation districts have been asked to send a brief summary of their problems so that the Commission will have advance notice of problems to be dealt with in visiting any particular project.

JOHN C. PAGE, *Commissioner.*

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YEAR

THE RECLAMATION ERA

OLUME 27 DECEMBER 1937 NUMBER 12

New Contract Covers Completion of the GRAND COULEE DAM

by S. E. HUTTON, *Assistant Director of Information*

DS to be opened at Spokane on December will cover the completion of the Grand ulee Dam, the construction of a power-se at the west end of the dam, and more n 300,000 yards of excavation. Materials l be furnished by the Government, and ver plant equipment will be installed by the reau of Reclamation, which is in charge of design and construction of the project.

The contractor will be allowed 4 years in ich to complete the work after the contract awarded by Harold L. Ickes, Secretary of Interior, and orders are given by him for work to proceed. John C. Page, Com-sioner of Reclamation, has expressed the e that the contract can be awarded mptly so that work will not be interrupted the dam site by a lapse of time between the npletion of the base of the dam under the rent contract and the commencement of k under the new contract.

Vast Quantities of Materials Required

Vork included in the new contract will olve the manufacturing and placing of ut 6,000,000 yards of concrete, nearly ce as much as was placed in the Boulder m. Almost 160,000,000 pounds of steel l go into the permanent structure, including 000,000 pounds of reinforcing steel, 10,000,- pounds of pipe and fittings, 50,000,000 nds of gates and operating devices, 000,000 pounds of trashrack metal work, l 16,000,000 pounds in penstocks, and 00,000 pounds in cranes, and miscellaneous tal work.

Important in Development of Columbia

The Grand Coulee Dam is the principal ineering feature of the Columbia Basin lamation project which will ultimately gate 1,200,000 acres of rich desert and dry-ning land in central Washington, regulate flow of the Columbia River, and develop trical energy to be used in pumping for

Concrete placing—final lift in block 57–L.

irrigation, and for other purposes, on the project and elsewhere. It is the "key" dam in the Army engineers' comprehensive plan for the development of the Columbia River, greatest potential source of power among the rivers of North America. Largest and uppermost of the 10 proposed dams between the Canadian border and the mouth of the Columbia River, the Grand Coulee Dam will form a reservoir extending to the international boundary, 151 miles away, and will impound about 10,000,000 acre-feet of water. By regulating the flow of the river, the Grand Coulee Dam will increase by 100 percent the potential firm power capacities of downstream power plants above the junction with the Snake River, and by 50 percent the firm power capacity of plants below that point, including that at Bonneville.

The completion of the Columbia Basin project will bring about, in the next 25 to 50 years, the establishment of 25,000 to 40,000 new farm homes on desert land, much of which was homesteaded about 30 years ago, only to be abandoned after a few years when droughts made dry-farming in much of central Washington impracticable. Farms and towns in the reclaimed areas are expected to provide homes and employment for 200,000 to 400,000 people. At the rate of 25,000 acres per year, 48 years will be required to put the whole district under irrigation.

An act passed by the Seventy-fifth Congress, limits the area that may be held, and the price at which land may be sold to settlers if it is to receive water from the project. Such provisions have been found to be effective in preventing the development of speculative land prices on other projects.

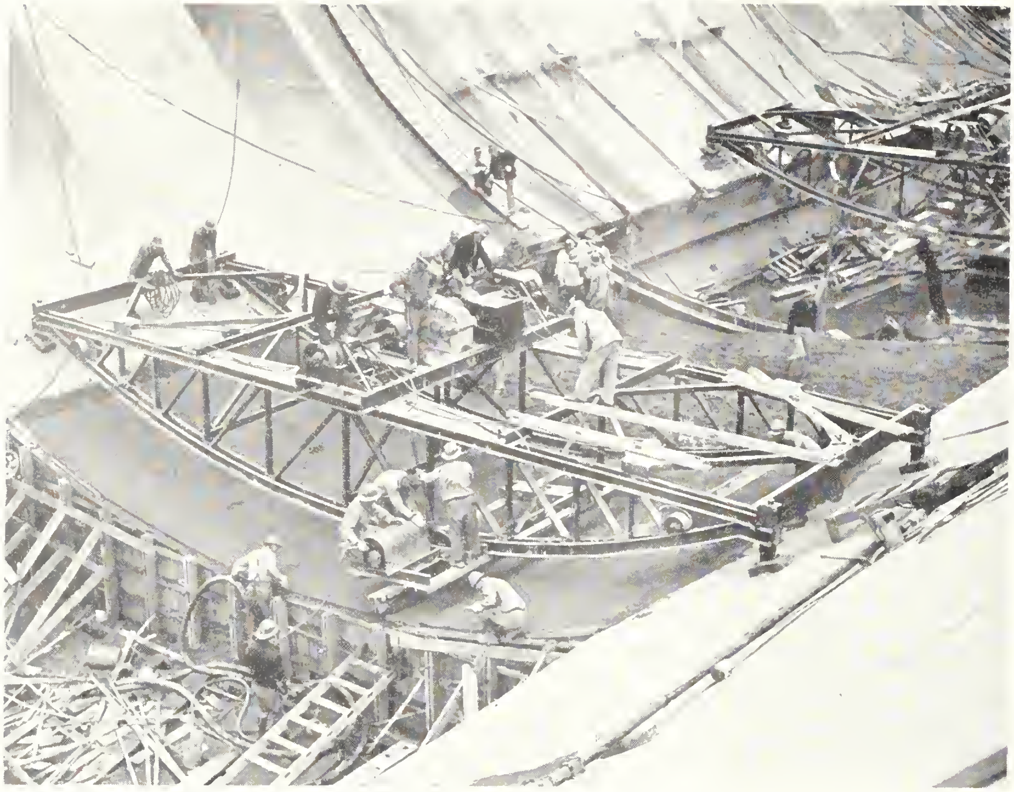
World's Largest Power Plant

The power plant at Grand Coulee will be developed as markets for its output develop. The ultimate installation will include, in each of the two power-houses, nine turbines rated at 150,000 horsepower each, and as many generators, each rated at 120,000 kilovolt-amperes. These will be, by far, the largest units of their kinds in existence. Three large station-service generating sets will be located in the west power-house.

It is estimated that the completed power plant will have an annual capacity of 8,320,-000,000 kilowatt-hours of firm power and 4,200,000,000 kilowatt-hours of secondary power. Of the latter, a maximum of 2,260,-000,000 kilowatt-hours may be used during the irrigating season for pumping, leaving nearly 2 billion kilowatt-hours of secondary power for sale each year. Fortunately, the high water and irrigating seasons coincide, so no primary power will be required for irrigation.

The dam will raise the water in the storage reservoir about 350 feet above the ordinary river level, and pumps must raise it about 280 feet more to a balancing reservoir in the

27737—37



Grand Coulee Dam. General view of concrete placing in bucket section, showing mechanical screed in action.

Grand Coulee, from which it will flow by gravity to the project lands. Twelve pumps, including two spare units, will provide for the ultimate requirements, each pump having a capacity of 1,600 cubic feet per second sufficient to furnish water for irrigating 120,000 acres. Each pump will be driven by a 65,000 horsepower motor.

Work done so far on the Grand Coulee Dam has included many tasks of the character and magnitude of major undertakings, and r new world's records in construction have made. Where four families lived in isol in 1933 there are now nearly a dozen t with a combined population of 15,000. years, workmen numbering 3,000 to have built the biggest man-made structu the world—the base of the Grand Coulee D bigger than the great pyramid of Ch man's biggest structure for 3,000 years, the Boulder Dam surpassed it in size. than 4,000,000 yards of concrete have alr been placed in the dam, with unprecede speed—as much as 15,844 yards in a s day.

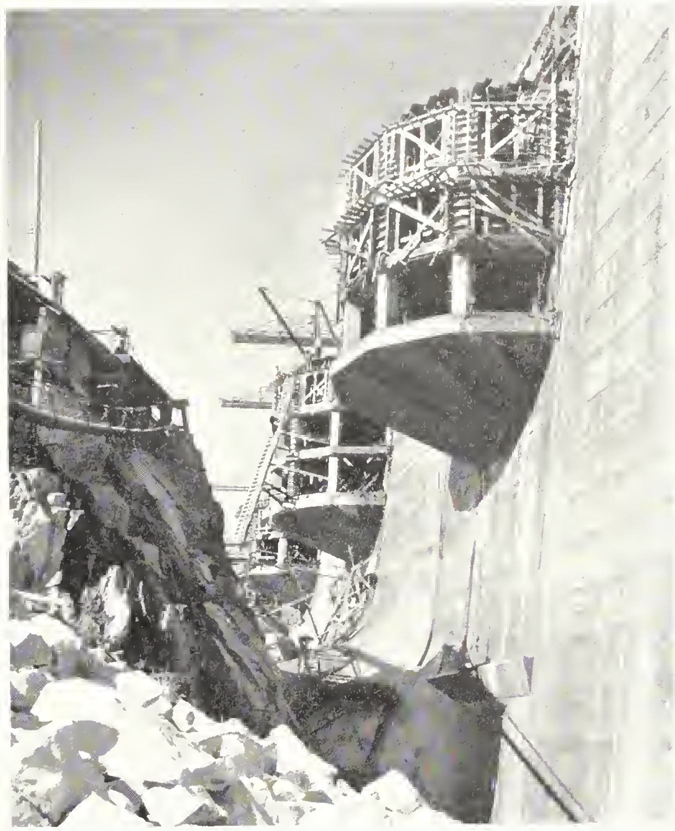
Into the vicinity of the dam site there built from existing lines, two hard-surf roads 30 miles long, a railroad 30 miles l and a high-tension transmission 30 miles A timber construction bridge, numerous porary pile bridges, and a steel highway b 950 feet long were built across the river. towns were built at the dam site—M City, the contractor's town, on the east to be dismantled when the dam is finis and Coulee Dam, the Government cam permanent town, on the west side of river.

World's Biggest Cofferdam Built

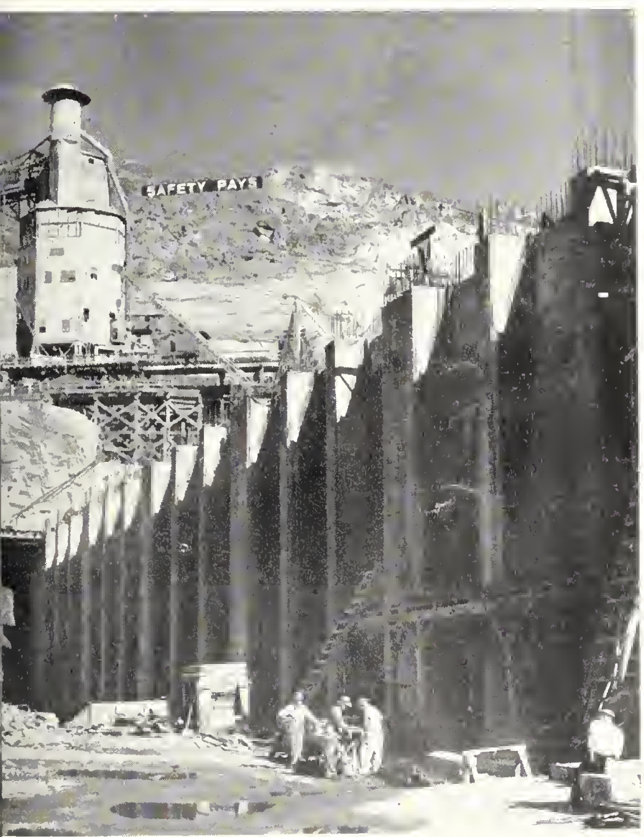
Along the west side of the river, there built in 90 days in the winter of 1934 1935, for the purpose of protecting the struction area from the summer flood w of 1935, the world's largest cofferdam, tending 3,000 feet along the river and en ing an area of 60 acres. The required

et piling, trucked in 30 miles, totaled 17,000 s in weight and 127 miles in length.
rom the area within the west side cofferdam re were removed, over a 60-inch belt conor, half-mile to a mile long, about 10,000,000 yards of material, which was dumped in Rattlesnake Canyon, upstream, at the mouth of the Grand Coulee. Material was moved at the rate of a million yards a month, and at a maximum rate of 50,839 yards in a single 24-hour day. Excavation at the dam site exceeded 20,000,000 yards, over a million yards of it being rock. Excavation at the gravel pit will exceed that at the dam site by the time the dam is completed.

ew over the east power-house and spillway sections showing construction work inside the cross-river cofferdams.



Ground view of trashracks of outlet works on blocks 59, 61, and 63 (in foreground).



Base of the east side power-house and east mix plant.

Looking over the west power-house section and diversion channel.

Second Largest River Man-Handled

Being second in flow of the rivers on the continent, the Columbia presented one of the greatest jobs of river diversion ever undertaken. The west end of the foundation having been built inside the west cofferdam, with low gaps to serve as diversion channels, the west cofferdam was opened, and the river given an alternative course, which it was compelled to take when the downstream cross-river cofferdam was closed December 12, 1936. By January 9, 1937, the upstream cross-river cofferdam had been closed, and 80,000,000 gallons of water pumped out of the enclosure. The construction of the cross-river cofferdams required more than 9,000,000 board feet of heavy timbers, ranging in cross-section from 12 by 12 to 16 by 24 inches, and in length from 40 to 60 feet. More than 60,000,000 board feet of timber have been used on the job. Steel sheet piling, used to face the sides of the cofferdams exposed to the river, totaled 2,200 tons.

Within this calendar year that part of the dam site formerly occupied by the river has been excavated; excavations on the east side of the river, begun in 1933, were completed; the two steel concrete-placing trestles were finished; and more than 2,000,000 yards of concrete were placed. The steel trestles, among the biggest bridges in the northwest, have been buried in the concrete, only the decks being salvaged. They are over 3,000 feet long, averaged 95 feet in height for the lower and 175 feet for the higher, and required the purchasing, fabricating, and erecting of 11,000 tons of structural steel by the contractor.

15 Months Ahead of Schedule

By midwinter, cofferdams and a half million yards of sand and gravel used to fill them and to protect them with berms will have disappeared from the river channel, forebay, and tailraces; and the waters of the Columbia will conceal most of the results of 4 years of work, and of the expenditure of millions of man-hours and millions of dollars in placing a 35-acre structure on bedrock under the bed of the river and below the deposits of detritus left in the canyon after the last great ice age.

It is expected that the present contractor, the Mason-Walsh-Atkinson-Kier Co., will complete its work about the first of the year, approximately 15 months ahead of the scheduled time. Then the Government may acquire a town, Mason City, the world's biggest gravel pit (capable of yielding 25,000 yards of pit-run material per day), the world's biggest washing and grading plant, with a daily capacity of about 16,000 yards of sand and gravel, the world's greatest concrete mixing and placing plant, with a daily maximum record of 15,844 yards, and all other of the contractor's equipment except certain mobile units. All such facilities will be made available to the successful bidder on the completion of the dam.

Horse Mesa Dam, Salt River Project, Arizona. Gate house and right spillway

Vale Project Community Organizations

ON October 2–3 the Pioneer Days celebration was held at Malin, Oreg. The event celebrated the twenty-eighth anniversary of the founding of the Bohemian colony at Malin. Regardless of the fact that cloudy and rainy weather prevailed during the 2 days, the celebration was well attended, and about 5,000 were fed at the barbecue.

The annual potato festival was held at Merrill, Oreg., on October 9–10. Excellent weather prevailed, and the celebration well attended. Governor Martin was guest of honor at the festival. At the an meeting of the Potato Growers Associat held during the festival, the entire boar officers was reelected.

• POST OFFICE •

CONSTRUCTION of the new Post O Building in Lovelock, Nev. (Humboldt p ect), which will also provide accommodat for various other Federal agencies, is ma favorable progress.

HASTA DAM *to be World's Second Largest Concrete Dam*

VISED PLANS for Shasta Dam, key unit he vast Central Valley project in Caliia, will make it the second largest concrete in the world.

he design approved by Bureau of Reclaion engineers calls for a straight-gravity rete dam approximately 560 feet high and 0 feet long, to be erected across the yon of the upper Sacramento River, 13 s north of Redding, Calif. Shasta Dam back up the waters of three rivers—the amento, Pit, and McCloud—a distance of miles to create a conservation reservoir a storage capacity of 4,500,000 acre-feet.

onstruction of the dam, designed to bring tiple benefits of improved irrigation, flood rol, navigation, salinity repulsion, and er generation to California's semiarid tral Valley, must await prior reconstruc- of 37 miles of the Southern Pacific Rail- now located within the proposed reser- site. Negotiations now under way be-en the Government and the Southern fic probably will reach a satisfactory lusion in time to start the railroad work after the first of the year.

s originally planned by State engineers, ta Dam was to be about 500 feet high, ting a reservoir of approximately 3,000,000 -feet. On the basis of recent comprehen- studies of the economic height, considering water resources and the manifold require-ts, Chief Engineer R. F. Walter of the eau of Reclamation, approved a recomdation for a reservoir of 4,500,000 acre-.

his storage capacity at the selected site ires a dam with a crest elevation 543 feet ve the present lowest bedrock determined oundation exploration. After excavation the necessary cut-off wall below bedrock, dam will rise probably about 560 feet ve the lowest foundation.

hasta Dam's only rivals in size will be hty Boulder Dam on the Colorado River Grand Coulee Dam under construction on Columbia River, both under the jurisdic- of the Bureau of Reclamation.

height, Shasta will be second to Boulder, ch is 726.4 feet high. Grand Coulee will 553 feet high. On the crest, Shasta will more than twice as long as Boulder—3,100 compared to 1,282 feet—but not as long Grand Coulee's 4,200 feet. In mass, sta will require approximately 5,700,000 ic yards of concrete, which is considerably more than the 4,360,000 cubic yards in Boulder Dam and power-house, but not comparable to the 11,250,000 cubic yards now being placed in Grand Coulee Dam and powerhouses.

Next to these three giants is the Chambon Dam in France, 450 feet high, followed by Hetch Hetchy Dam, a part of San Francisco's water-supply system in the Sierra Nevadas, which recently was heightened to 427 feet, and Owyhee Dam in eastern Oregon, another Bureau of Reclamation structure, 417 feet high.

Walker R. Young, of Sacramento, the Bureau's construction engineer for the Central Valley project, who also was the construction engineer on Boulder Dam, said Shasta Dam will require concrete enough to build a solid monument a city block square and slightly higher than New York's Empire State Building. He said it would take a freight train more than 200 miles long to haul the cement to be used in mixing this concrete; and that Shasta Reservoir, when full, will hold water enough to cover the entire city of Chicago to a depth of 35 feet.

Incidental to the primary functions of Shasta Dam will be the generation of about a billion and a half kilowatt-hours of electricity annually. The initial hydroelectric installation will be for 280,000 kilowatt (375,000 horsepower) capacity, with provision for future enlargement to 350,000 kilowatts (470,000 horsepower).

Shasta Dam will be one of two large concrete dams on the Central Valley project. The other, Friant Dam on the upper San Joaquin River east of Fresno, Calif., will be 260 feet high and 3,330 feet long, creating a reservoir of 450,000 acre-feet. Shasta and Friant Reservoirs will be operated to conserve and regulate the principal water resources of the combined Sacramento and San Joaquin River valleys to serve a rich agricultural empire partially threatened with reversion to desert by drought and salinity. More than a million acres in the Sacramento and San Joaquin basins face an acute water shortage which is expected to be relieved by the Central Valley project.

Shasta Dam Site on the Sacramento River, a short distance above Redding, Calif.

Progress Along the Overland Trail

By H. W. BASHORE, *Construction Engineer, Kendrick Project, Wyoming* [1]

THE 1937 convention city of the National Reclamation Association, the Kendrick project, and all developments of the Federal Government on the North Platte River are in a region of great historical interest. These developments are along the great Overland Trail over which, from about 1843 to 1869, more than 300,000 immigrants traveled on foot, pushing hand carts, or with wagons drawn by oxen, mules or horses, and on horseback. These immigrants were on their way to the Oregon country, California, and Utah.

The Platte River is approximately 900 miles in length from its confluence with the Missouri to North Platte, Nebr., where it divides into the North Platte and South Platte, and following the North Platte branch to the mouth of the Sweetwater and to the head of this stream at South Pass, Wyo., Nature's Gateway to the Pacific coast. Throughout this distance, the California, Oregon, and Mormon Trails, were practically identical and constituted the Overland Trail.

The natural landmarks which guided the immigrants in those days are still in evidence, such as Chimney Rock and Scotts Bluff in Nebraska, and in Wyoming, Fort Laramie, the Warm Springs at Guernsey, Immigrant Ridge west of Casper, and Independence Rock and Devil's Gate on the Sweetwater. History records a few of the most notable Indian battles along this route, such as the Grattan Massacre in 1854, east of Fort Laramie, where Lieutenant Grattan and 29 men were killed, and the battle at the Platte River bridge near Casper in 1865, where Lt. Casper Collins and 27 men were killed. The hardships and privations of the immigrants on this part of the overland trail were probably climaxed with the plight of the 600 persons in the Mormon hand-cart expedition, 20 of whom spent the winter at Devil's Gate and were forced to eat cow hides for 2 weeks to prevent starvation.

18th Century Explorers

On account of the money to be made out of trapping fur-bearing animals, this route had been explored and traveled by trappers and traders in the early part of the Eighteenth Century. Consequently, when the Government became interested in the Oregon country and the Lewis and Clark expedition was fitted out in 1804, the services of the trappers were available as guides for the expedition. Later in 1810, when John Jacob Astor organized the American Fur Co. and sent his expeditions by boat around Cape Horn and overland to the mouth of the Columbia River, the Platte River, Sweetwater and South Pass route was used by the party returning on land.

When a part of this expedition was returning on foot under the command of Robert Stuart, after suffering untold hardships, and after having followed the river closely past the Pathfinder Canyon and along the rim of the canyon just above the Alcova Reservoir, which Stuart named the "Fiery Narrows", and traveling through the Alcova Reservoir site, they reached a point on the Platte River now known as the Bessemer Bend, about the first of December. As plenty of game was in evidence and timber available, they decided to spend the winter there and built the first log cabin of record in Wyoming. After they had completed their house and were well stocked with provisions, they were visited one morning by a war party of Arapahoe Indians. The Indians claimed that they were in pursuit of a band of Crow Indians who had raided their village a short time before and stolen most of their horses. They were fed by Stuart and his party and proceeded on their way. After the Indians left, Stuart decided it would be unsafe to remain longer in the country and moved on down the Platte River to about where the town of Gering, Nebr., is situated, where they spent the remainder of the winter.

Many trappers and traders whose names are now famous in history were closely associated with the development of this great overland route along the Platte River. The principal of these who acted as guides and hunters for exploring expeditions along this route were Ramsey Crooks, Kit Carson, Thomas Fitzpatrick, Lucien Maxwell, Alexander Godey, Jim Bridger, and Robert Campbell. William Sublette, a trader, is credited with having brought in the first wagon train of 11 wagons drawn by mules in 1830. Captain Bonneville is recorded as having camped in 1832 at Scotts Bluff, Nebr., with twenty 4-mule team wagons and as being the first explorer to reach South Pass with a wagon train. Parker and Whitman traveled through here in 1835, Father DeSmet in 1840, and Brigham Young in 1847. Probably the most important exploring and surveying expedition was made by Capt. John C. Fremont in 1842. This expedition was equipped with the surveying instruments of that day and Captain Fremont at various places made observations to determine the latitude and longitude. He was accompanied by a German topographical engineer, Charles Preuss, whose maps show a highly developed skill. Captain Fremont outfitted his expedition at St. Louis, Mo., with French-Canadians who had had previous experience in trapp outdoor life, and were especially well quali for his purpose. One of these men, F Lajeunesse, was a very exceptional man developed the admiration and confidenc Captain Fremont. He was an expert sw mer, boatman, and displayed exceptional c age and resourcefulness. He was alw selected by Captain Fremont where g endurance was required and always acc panied the captain on especially hazard side trips. Captain Fremont's expedition lowed the Platte River and the North Pl River closely to the present Alcova Dam from that point proceeded overland to Sweetwater below Independence Rock. F there they followed the Sweetwater up to head, crossed South Pass and later scaled mont Peak, which is about 13,730 feet in vation. Lajeunesse was one of the few who scaled this peak with Captain Frem and at that place, where all of the party came exceedingly fatigued and ill, Lajeun showed no discomfort or fatigue and Cap Fremont states in his diary that he displa more of the endurance of a mountain than of a man. After Fremont Peak been scaled, the party turned back over So Pass and followed the Sweetwater down point several miles above where it emp into the Pathfinder. The party was divi here. One party was instructed to go o land and stop at Goat Island, about 1 below the Alcova Dam, and await the arr of the second party, which would proc down the Sweetwater and the Platte by b Captain Fremont's diary relates the exc ment and difficulty in getting the boat thro the canyon where the Pathfinder Dam stands. The Pathfinder Dam takes its na from Captain Fremont, the pathfinder of Rocky Mountain region. The current th was very swift but they managed this very successfully without mishap and quite elated and able to handle the boa much more difficult water. However, in t eling on down the Platte River, they ente the canyon called the Fiery Narrows Robert Stuart, and in this canyon misfort overtook them. The boat was upset an 12 days' supply of provisions, together the surveying instruments and records, dumped into the river along with the m Several of the men could not swim but v held up by those who could and finally entire outfit floated out of the canyon to quieter waters at the upper end of the Alc Reservoir.

At this point Lajeunesse recovered the and nearly all of the records and instrume

[1] Address delivered Oct. 12, 1937, at the Sixth Annual Convention of the National Reclamation Association in Casper, Wyo.

emont decided to cache the equipment and oceed on foot down to Goat Island. On the ite they passed through the Alcova Canyon, iich Fremont named Hot Springs Gate on count of the prevalence of hot springs. emont relates he was not able to measure e temperature of the water but he could ld his hand in it two seconds. After passing rough the Alcova Canyon, the party finally iched Goat Island and rejoined their comnions. Captain Fremont's diary is full of aise for his favorite man, Basil Lajeunesse.

Origin of name "Seminoe"

Lajeunesse accompanied him on a second pedition in 1843 and 1844. He established trading post at Devil's Gate in 1858 and is engaged in this business until 1862. He is on friendly terms with the Sioux Indians d married a Sioux squaw. Lajeunesse was ven another name by the Sioux Indians, at of "Cimoncau" or sometimes spelled Cimineau". He loaded up 15 pack horses e morning at his trading post at Devil's ate and with two men started to Deer Creek trade with the Indian village in that locality. n this trip his horses were killed, his goods olen, and he was himself murdered. Two riations are given of this – one that he was irdered by the two men who accompanied m, and the other that he was killed by hose Indians. The Seminoe Mountains and e Seminoe Dam are named after this reirkable man.

The hot springs in the Alcova Canyon entioned by Fremont, continued to be an ject of interest to the white settlers who lowed. In 1891 a syndicate was organized develop a health resort and literature was blished to show the great benefits to be tained by drinking and bathing in the edicinal waters. Mokler's history of Naona County quotes from some of this erature as follows:

"Until the railroad is built in," the syndicate nounced, "we will run a daily stage line of -horse stage coaches from Casper over the mantic and scenic road. We will build a idge across the river about 20 miles from asper, and this structure will be built tirely of native lumber, with piers of differt colored stone. We may also put in a line small steamers and sailboats between asper and the springs for those who would efer the water route.

"All the buildings and improvements at the rings will be modern and of the latest and ost improved designs. There will be pavilns, driveways, walks and cozy nooks, and rk caverns, glass bath tubs, plunge and imming baths, boats and steam yachts, and ery convenience for the accommodation of r guests, and in a few years the Alcova Hot rings will be the Arkansas of the West."

Seminoe Dam Construction Begun

A town site was laid out, sagebrush was ubbed out of the streets, lots were sold, t somehow sufficient finances were not forthcoming to advance the project and no further development was made until the Bureau of Reclamation in 1933 was confronted with the problem of building a dam on a foundation full of hot springs. The flow of these springs at that time, at the low point of the foundation excavation, probably amounted to as much as 20 cubic feet per second. To build the dam where water was running freely was out of the question and it was necessary to drive the water away from the abutments and the foundation. This was successfully accomplished by grouting and when the embankment work was started, various small leaks in the foundation, principally near the abutments, amounted in total to about 7 gallons per minute. This grouting required drilling 79,630 linear feet of holes from 25 to 150 feet deep at a cost of $169,000 and forcing into these holes cement or a mixture of cement and sand in the amount of 238,000 cubic feet, at a cost of $171,000. The pressure used in forcing this grout into holes and crevices varied from 25 to 150 pounds per square inch. This structure is being built by W. E. Callahan Construction Co. and Gunther & Shirley, contractors. The resident engineer, who has supervised the activities of the contractors, is Mr. John Beemer.

The construction of dams by the Bureau of Reclamation on the Platte River is named in order beginning upstream:

The Seminoe Dam, a concrete arch structure, 258 feet high, now under construction.

The Pathfinder Dam, a granite masonry arch structure, 218 feet high, completed in 1909.

The Alcova Dam, an earth and rock-fill embankment, 266 feet high, now nearly completed.

The Guernsey Dam, an earth and rock-fill embankment, 135 feet high, completed in 1928.

Irrigation began on the Platte River in 1855 at Fort Laramie, Wyo., where the Mexican people living near the fort irrigated their gardens. Today nearly 1,000,000 acres of land are being irrigated along this river.

MIGRATION *to Pacific Northwest Continues*

(Excerpt from Land Policy Circular, October, 1937)

TWELVE THOUSAND farm families, or approximately 60,000 persons, left the "dust bowl" areas of the Great Plains and settled in Oregon, Idaho, and Washington between January 1936 and July 1937, according to a *farm security administration* survey of the drought influx.

"Conservative estimates of county rehabilitation supervisors, based on school and car registrations, contacts with county agents and relief offices and rehabilitation loan applicants, report 7,400 drought families in 1936, and 4,600 the first 6 months of 1937, as permanently or temporarily settled in the three States," Walter A. Duffy, regional director recently announced.

Probably fewer than 5,000 of the total migrants have succeeded in locating on a farm through a purchase contract, lease or other tenure agreement. Many have settled temporarily in shacks, abandoned farms, tourist camps, and vacant buildings, existing as best they can on seasonal farm labor or other miscellaneous employment. Others are on farms in nonagricultural cut-over and sage-brush areas.

The greatest need of the new settlers, Duffy pointed out, is guidance in helping them locate on good agricultural lands. To this end, the Farm Security Administration is asking new settlers to consult county rehabilitation supervisors and county agents in order that they may find the best land now available for settlement. The problem looms especially difficult when it is realized that at present it is practically impossible to rent or lease an economic farm unit in the Pacific Northwest without replacing present operators.

ELWOOD MEAD

Memoirs of a busy, useful life of outstanding achievements

THE Transactions of the American Society of Civil Engineers for 1937 (Vol. 102, pp. 1611–1618), contains a memoir of the late Dr. Elwood Mead, former Commissioner of the Bureau of Reclamation, by Raymond F. Walter, Chief Engineer, Bureau of Reclamation, William H. Code, Consulting Engineer, and Prof. Frank Adams of the University of California. The memoir contains tributes by Hon. Franklin D. Roosevelt, President of the United States, Hon. Harold L. Ickes, Secretary of the Interior, and other officials and former associates, also indirect statements from Australia and quotations from the Arizona Republic, the Daily News, the Engineering News-Record, and from the University of Michigan showing the high esteem in which Dr. Mead was held.

RESOLUTIONS *Adopted at National Reclamation Association Meeting*

AT the National Reclamation Association meeting, which was held at Casper, Wyo., on October 12-14 last, the resolutions adopted relating to reclamation and its activities include the following:

Repayment based upon the ability of the settler to pay as reflected by the current gross returns from the land;

That a classification or reclassification of project lands be recommended to be made to facilitate the application of this flexible repayment plan;

That the National Reclamation Association pledges continued close cooperation with water users and a forward looking program on western reclamation;

That the association instruct its directors and officers to investigate the regulations of the land bank in arriving at loanable value on land under Federal reclamation projects and take such action as they deem proper to prevail upon the Commissioner to change such regulations so that the amount of the lien to the Federal Government for construction charge repayment be deducted from the value of farm arrived at by the Federal appraiser and the maximum loanable amount be 50 percent of this remaining value;

That Congress be asked to pass legislation to authorize the Secretary of the Interior to reclassify project lands or transfer water rights, within Federal projects in States where the State law will permit, from marginal and submarginal lands to good lands, either private or public domain, and that all payments on construction charges on such marginal and submarginal lands be credited to the new water rights allowed.

That the association go on record as favoring and urging a program by the United States Bureau of Reclamation that will provide an adequate water supply for lands already under cultivation;

That the association support the efforts of the National Weed Committee of the National Plant Board in the establishment of a national noxious weed program to be partly supported by Federal funds on a cooperative State-Federal basis;

That out of any Federal funds provided for noxious weed control, allocations be made to the proper Federal agencies for the eradication of these weeds upon federally owned or controlled lands;

That this association urges that no Civilian Conservation Corps camps be moved from any irrigation project until the programs on which they are working be completed;

That it is the sense of this meeting that steps should be taken by the Federal Government to permit the employment of needy family heads, living in the vicinity of work, who shall be given equal consideration for employment on Federal projects in their community;

That the President and the Congress of the United States are hereby requested to make prompt and suitable provision for the creation of some agency empowered to make loans and grants to worthy irrigation districts and to other needy sponsors of useful conservatio projects.

That we recommend to the Federal Co gress that an appropriation of not less tha $500,000 be provided for the Bureau of Recl mation for the purpose of undertaking t development of small reservoirs and dam and for the study and development of a co prehensive program looking to the develo ment of the required small dams necessary t provide supplemental water, and conser water released for power purposes.

That this association reemphasize the nee for the continuance of topographic mappin stream gaging, ground water investigation and snow surveys for irrigation water suppl forecasting, and urges continuing congressiona support for these activities.

That we commend President Franklin I Roosevelt for the aggressive leadership he h given to the conservation movement; t Department of the Interior, and Secreta Harold L. Ickes for unwavering devotion conservation principles; the Water Resourc Committee and the Bureau of Reclamati for great contributions this year towa broader understanding of the problems i volved in and elucidation of plans for conse vation of water on a national scale;

That the National Reclamation Associati commends the effective service that the Bure of Reclamation has rendered to the Natio and is opposed to the enactment of legislati that would destroy its effectiveness or ind pendence, curtail its functions and operatio or transfer them, along with their relat projects, to regional or any other gover mental agency or agencies;

That whereas the Department of Agric ture is engaged in an extensive program connection with prevention of soil erosion, a the United States Army Engineers are e gaged in a program of building dams and oth facilities for flood control and navigation;

Therefore, be it resolved, that we reco mend close cooperation between the gover mental agencies mentioned and the Bureau Reclamation, in carrying on the work c scribed, to the end that water stored shall, far as possible, be utilized for irrigati domestic, and power uses, but no water sto in arid or semiarid States shall be released f navigation when needed for any of the us above named.

The officers of the National Reclamati Association elected or reelected at the Cas meeting are as follows:

O. S. Warden, president; Ora Bundy, fi vice president; Robert W. Sawyer, seco vice president; H. Lloyd Miller, treasur F. O. Hagie, secretary-manager

Mormon Flat spillway, Salt River Project, Arizona, showing erection of left gate. Method of trimming channel walls shown in background.

ecifi-on No.	Project	Bids opened	Work or material	Low bidder Name	Low bidder Address	Bid	Terms	Contract awarded
974-D	All-American Canal, Ariz.-Calif.	Oct. 6	1 gasoline-engine generator unit for installation at Imperial Dam.	Maurice W. Brainard	Los Angeles, Calif	$2,950.00		Oct 23
975-D	Kendrick, Wyo	Oct 8	Penstocks and outlet pipes for Seminoe Dam	Treadwell Construction Co	Midland, Pa	22,176.00		Do.
978-D	Boulder Canyon, Ariz.-Nev.	Oct 13	Strainers, water jet eductors, water-pressure regulators, float cages with valves, and air-pressure relief valves	Andale Co	Philadelphia, Pa	[5] 3,581.00	F. o. b. Boulder City	Oct 27
				Schutte & Koertig Co	do	[6] 9,650.00		Oct 28
				Fisher Governor Co	Marshalltown, Iowa	[7] 842.20	F. o. b. Boulder City	Do
979-D	Kendrick, Wyo	Oct 18	Bulkhead gates and gate frame assemblies for outlet works and power penstocks at Seminoe Dam.	Berkeley Steel Construction Co.	Berkeley, Calif	11,750.00		Nov 10
				Consolidated Steel Corporation, Ltd	Los Angeles, Calif	[1] 12,292.00		Do
980-D	All-American Canal, Ariz.-Calif.	Oct 22	18 radial gates for power drops and New Briar turnout	do	do	8,060.00		Nov 2
				Omaha Steel Works	Omaha, Nebr	[2] 3,172.00	Discount ½ percent	Do
				Lakeside Bridge & Steel Co	Milwaukee, Wis	[3] 3,410.00		Do
				Treadwell Construction Co	Midland, Pa	[4] 1,254.00	Discount 1 percent	Nov. 1
593-A	Rio Grande, N. Mex	Oct. 18	5,380 barrels of portland cement in cloth sacks.	Southwestern Portland Cement Co	El Paso, Tex	15,279.20	Discount 10 cents per barrel	Nov 10
981-D	All-American Canal, Ariz.-Calif.	Oct 25	Radial gates	Pacific Iron & Steel Co. Ltd	Los Angeles, Calif	22,747	Discount ½ percent	Nov 20

[1] Items 1 and 2 [2] Schedule 1 [3] Schedule 2. [4] Schedule 3 [5] Item 1. [6] Item 2 [7] Item 3 [8] Item 4

DESCHUTES *Project Is Approved*

CRETARY of Interior Harold L. Ickes announced that the President has apved the Department's finding that the chutes Federal Reclamation project near dras, Oreg., is feasible.

he finding of feasibility and its approval he President is required under reclamation prior to commencement of actual conction of a new project.

he Deschutes project was adopted by the gress last year when an appropriation of 0,000 for commencement of its construcwas included in the Interior Department ropriation bill for the fiscal year 1937. s money was continued available for the al year 1938, although no new appropria- was made this year, since the project not yet been started.

he Deschutes project is designed to provide gation water for 50,000 acres of dry but ile lands immediately north of Madras, on east side of the Deschutes River in central gon. The principal engineering features the project, as now planned, include kiup Dam and Reservoir on the Deschutes er, designed to conserve and divert 209,000 e-feet of water, a main canal extending n Bend, north for 65 miles, to the Agency ins near Paxton, a steel siphon, 7,060 feet g, near Terrebonne, across the Crooked er, smaller canals and laterals and other al structures.

he Wickiup Dam, as now proposed, would located 40 miles above Bend and would be earth embankment, 83 feet high and 3,100 long, with auxiliary dikes on either side, 14,900 feet long, the other 3,600 feet.

The main canal would be located largely through rock cuts and would require considerable concrete and gunite lining.

Project Cost and Repayment Plan

The estimated cost of the Deschutes project is $8,000,000. Work estimated to cost slightly in excess of $2,000,000 and including clearing the reservoir, which will cover 11,200 acres, and lining the canals, preparing concrete aggregates, etc., will be done by Civilian Conservation Corps men.

The remainder of the cost of the project will be repayable in 40 years by water users on the project lands.

Most of the 50,000 acres to be irrigated in times past have been cultivated, with grain crops predominating in years of better rainfall. Houses and barns still dot the area, although most of them are unoccupied. The few who have managed to remain on the land have done so only through outside assistance. Weather records show conclusively that the area cannot be farmed permanently without irrigation.

The people residing in the area have organized and approved a tentative repayment contract.

Lands of the project will be divided into single-family farm units. Present owners will be permitted to retain 40 acres for a single man or 80 acres for a family. The remainder of their holdings will be appraised by the Government and its sale required, at the appraised price, to new settlers.

The lands embraced in the project include only the best in the area. Rough lands and poor soils have been eliminated. The remaining land can easily be prepared for effective application of water. Properly prepared and properly cultivated, good yields of all crops grown in that locality are assured. With settlers carefully selected and suitably equipped for the new venture, success of the Deschutes project reasonably may be anticipated.

California Almond and Olive Crops

IN spite of the largest crop of almonds ever raised in the State of California, the growers who belong to the association will receive very good prices for their nuts. The independents, at the beginning of the season became panic-stricken when reports of the large crop became known, and sold for prices which for a while depressed the market. The prices set by the Italian Government for shelled nuts delivered in New York, however, were high enough to allow the California Almond Growers' Exchange to stick by the schedule of prices set at the beginning of the season. Prices for olives are governed under a code set up by a State prorate program, and this year's prices are such that the growers will receive very good returns. The market for American grown and processed olives is expanding and slowly but surely the American public is being educated to appreciate the superior quality of our products.

• SHEEP •

THE Hyslop Sheep Co., which has operated feeding pens at Granger, Wash. (Yakima project) for 10 years, has increased its facilities this year to feed 20,000 sheep. Lambs were shipped in to pasture until feeding activities began the latter part of October.

PROBLEMS

Peculiar to Irrigation Farming

by O. W. ISRAELSEN [1]

CAN you imagine the tremendous changes that would be required in American agriculture east of the one-hundredth meridian, if the annual rainfall should decrease to 15 inches or less, thus making it impossible to grow crops without irrigation? Suppose the farmers in the States east of the Dakotas, Nebraska, Kansas, Oklahoma, and Texas should be required to build large storage dams, diversion weirs, headgates, flumes, spillways, siphons, drops, chutes, and long canals in order to continue their farming activities; and to convey water great distances to their lands, and try to spread it uniformly over the land surface from 4 to 10 times or more each season. Then you can conceive of some of the problems that are peculiar to irrigation farming.

Satisfactory solution of these problems commands the efforts of statesmen, agricultural engineers, attorneys, economists, and scientists—particularly agronomists, soil specialists, and irrigation scientists—as well as the irrigators themselves.

From the beginnings of modern irrigation in America, the problem of providing for an ample and safe supply of irrigation water has perplexed irrigators. For the pioneer irrigators there was plenty of water in the streams and their problem was to build safe diversion dams and ditches of adequate capacity. They needed and used only the natural flow of the streams, which today is entirely inadequate. More and more it is necessary for the irrigation farmer to store the floodwaters, either in surface reservoirs or in ground-water reservoirs, and hold them till needed for irrigation.

Parker Dam. Close-up of downstream face of dam. Average elevation of concrete, 210 feet.

Storage Problem

The problem of storing water for irrigat in surface reservoirs has become a widely r ognized problem peculiar to irrigation farm and hundreds of millions of dollars have b spent for this purpose. Yet the task is l than one-half complete. On some river s tems, such for instance as the Sevier River Utah, practically the entire annual wa yield is controlled by storage in surface res voirs. All of the water produced each y by this river since 1922 has been used for c production, and there has been no waste.

Similar water control is needed on ot river systems and will be needed more a more as the years go by.

The annual water yield of a river and distribution of the yield during the year v between wide limits. Some rivers dur years of maximum yield produce four to times as much water as they do in years minimum yield and similar variations occu the seasonal distribution. Probably most the rivers of the West yield less water annua than is needed for all of the arable land which water may be used for irrigati Therefore, the problem of determining the a of land for which the water will provide a s and ample annual supply is not only pecu to irrigation farming, but it is also very co plex. During cycles of wet years there i tendency to expand the area to an extent yond which the water supply will prov ample water during cycles of dry years e though all of the water is stored. The f reservoirs were small and were provided constructing low dams. The problem of to is to build high dams from 100 to 500 feet more, and this demands the cooperative eff of many irrigation farmers with governmen agencies, both State and Federal.

Hundreds of thousands of acre-feet of wa flow each year into ground-water reserv which provide storage till the time of ne To get water from such reservoirs it is usu necessary to operate pumps. The capac of pumps used for this purpose ranges fr only a fraction of a second-foot (cubic f per second of time) to more than 12 seco feet and the height of lift from less than feet to more than 800 feet. Some of

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blems of irrigation farming are to use our und-water reservoirs more completely and ciently; to avoid annual water draft in ess of the annual water recharge; and to vide artificial recharge in places where natural recharge is inadequate to meet pumping demands; also to protect all ted rights to ground water without ruinous gation costs.

Vith but a few exceptions today water st be conveyed long distances from the ces of storage in the reservoirs and the nts of diversion from streams to the irri-ed land. Reservoirs are sometimes lo-ed 200 miles or more upstream from the ls that need irrigation. Natural water rses in which late-season nonstored water vs must also be used to convey stored er from reservoirs owned by different ups of farmers. The water that is released n storage is neither "branded nor marked." must be commingled with the water owned the early appropriators. Some water is vitably lost in conveyance. To determine amount of loss and to apportion the proper ounts to each of the irrigation companies, l later to the many irrigators, is a problem t requires a high degree of skill and confi-ce to solve with satisfaction.

Water Carriers

rrigators have built diversion weirs ranging n less than 100 feet in length to 5,000 feet more. The water supply for the farm ends on the adequacy and the stability of diversion weir; if it fails the farmer is hout water.

Canals built along steep side hills, some-es in unstable materials, are eve more ceptible to damage and failure than ersion weirs. Eternal vigilance and per-ent effort on the part of irrigation com-y officials is required to keep canals safe l to convey water many miles to places use. One of Utah's canals having a maxi-m capacity of more than 300 second-feet more than 60 miles long; Idaho has canals nearly equal length and much larger acity, and California has one more than miles long with a capacity of 7,000 second-t or approximately 3,500 Utah "irrigation eams."

t is a real problem peculiar to irrigation ming to keep thousands of canals clean l safe and to make them function efficiently. Although every irrigation farmer may be erested in the storage of water and its veyance to his farm, yet these affairs are ally under the direct supervision of his resentatives—that is, the directors of a porate irrigation enterprise. However, in application of water to the land, every gation farmer is *directly* concerned. His ective is to apply the water in a way that l assure storage of the maximum amount capillary water in the soil for use by crops l reduce to a minimum his wastes by sur-e run-off, deep percolation, and evapora-n. Uniformity of distribution of water over the land surface contributes to the attainment of his objective. Solving of the water application problem would be easy for the irrigation farmer if he could at reasonable cost "make it rain" uniformly at a rate that would not exceed the rate at which his soil will absorb the water. Considering irrigation as a whole, there is but a very small percent of the land irrigated by the "rainfall" or spray method. The irrigation farmer is therefore confronted with the problem of applying water by flooding or in furrows. He must, as a rule, attempt to adjust the time rate of application so as to get the most uniform distribution practical. The problem is complicated by the number of the variables with which he is confronted, and by the wide degree of their variability. There is no such thing as complete uniformity on the irrigated farm. The land topography is variable; on one part of many irrigated farms the land has a flat and nearly smooth surface, while on another part it is steep and irregular. The size of the stream delivered the farmer, the size of the farm, its shape, and the nature of the crop are significant variables; but of all of the variable factors, the variability of the soil is the most difficult to cope with. Soils vary in depth, in structure, in texture, in water-holding capacity, and particularly in permeability. It is not unusual to find one soil having a permeability 100 times that of another soil nearby. Comparisons of the permeability of the surface foot of a clay soil with that of the underlying sand and gravel made recently by the Utah Agricultural Experiment Station show a variability of 1 to 100,000. The irrigation farmer must deal with these variables in his attempt to spread water uniformly over his land.

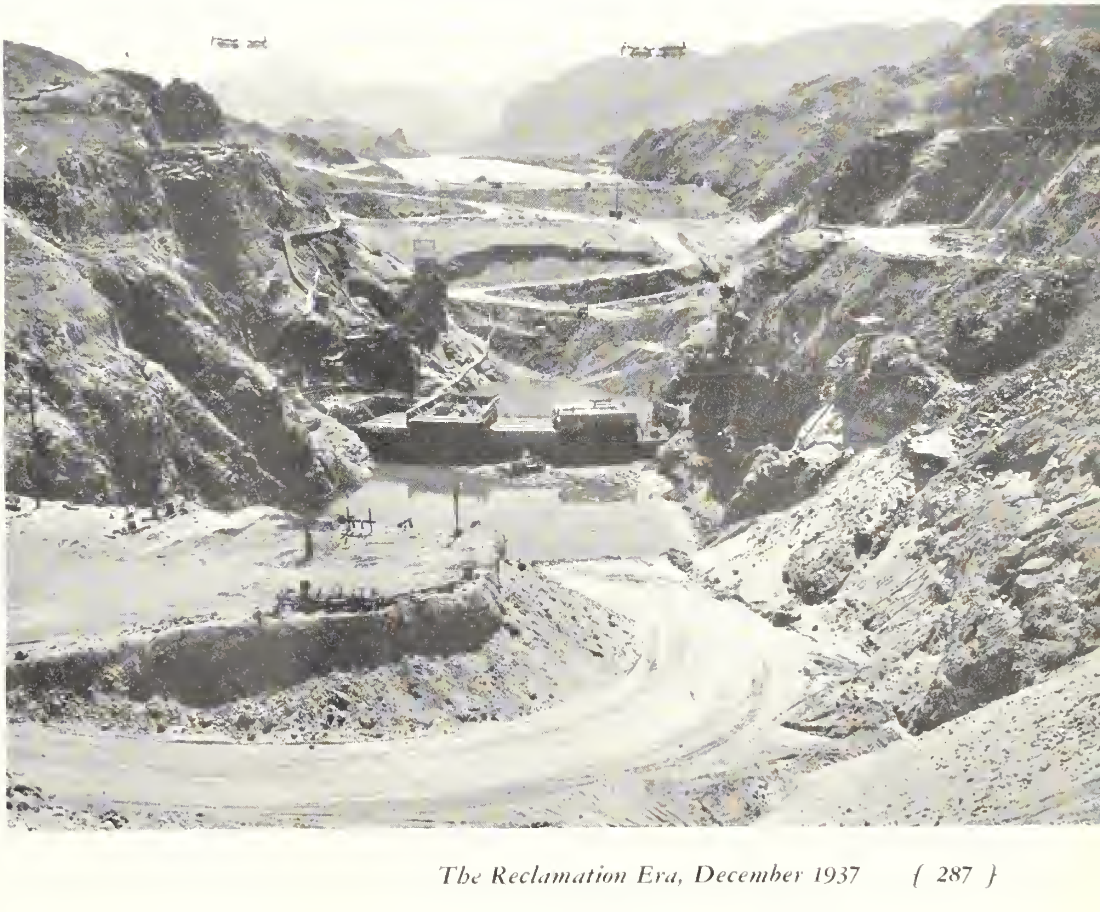
Some soils absorb water so slowly that many hours of contact of the water and the soil are required to get the necessary amount of moisture stored in the soil to the desired depth—others absorb it so rapidly that the soil is fully wetted and large, deep percolation losses occur near the upper ends of the fields before the water reaches the lower ends, and so the irrigation farmer must continuously seek to obtain a balance between the size of the stream he uses, the length of his irrigation "run," the width of the land covered at one time, and permeability of his soil.

Is it any wonder that he needs the assistance of the agricultural engineer to find the methods and the procedure that will assure the highest efficiency consistent with economy?

Variable Soil Moisture

The irrigation farmer cannot produce satisfactory crops without keeping readily available moisture in his soil during the growing season. One of his problems is to find how much mois-

Parker Dam under construction. Average elevation of concrete, 278 feet. Looking downstream.



ture there must be in his soil in order that his crops can get water easily and grow satisfactorily. Plants cannot grow without food, and they cannot get food without water. Some soils may contain as much as 16 to 18 percent of moisture, dry weight basis, and yet have none available to plants, whereas other soils may contain only 5 percent or even less, and yet have a readily available supply for crops. The farmer must therefore learn how to determine quickly and easily whether his soil has a supply of readily available moisture, and thereby tell when irrigation is needed.

The appearance of the growing plant and the moisture condition of his soil are two major indices for finding when irrigation is needed, and he must, if he would get the most out of his soil and water resources, learn how to interpret the appearance of his crops and to find by soil borings and inspection whether his soil contains readily available moisture.

The irrigation farmer should know how long it will take him to fill the capillary reservoir of his soil with the stream of water that he uses. If, for instance, his soil needs to be wet to a depth of 4 feet and if the capacity of the capillary reservoir of the soil is 1 inch depth of water to a foot depth of soil, he knows that he must provide 4 acre-inches to each acre of land. Knowing the area of land that he wants to irrigate, he can compute the time required with a given stream to get the volume of water to be stored in the soil.

It is too costly for the average farmer to determine directly the capacities of his capillary water reservoir, but if he can get this desired information from public research agencies, then he can proceed to apply water to his land intelligently and efficiently.

He must, to be sure, understand the elements and practices of water measurement, and he should see clearly that, if he applies more water than is needed to fill the capillary soil-water reservoir, the excess will not only be lost, but it will percolate down to the ground water and ultimately cause a rise of the water table with its inevitable contribution to the alkali menace.

Soluble salts, such as the chlorides, sulphates, and carbonates of sodium, are toxic to plants and injurious to soils, if they occur in excessive amounts. From soils having a water table near the surface there is continuous evaporation of water. The soluble salts, or alkalis, do not evaporate—they become concentrated on or near the land's surface and make the soil nonproductive. The irrigation farmer who owns land subject to alkali accumulation and concentration, must exert continuous vigilance to maintain the productivity of his soil.

Adequate underdrainage which will assure a general lowering of the water table and the downward movement of alkali salts with the excess irrigation water is the basic means of permanent alkali control. This fact is well recognized by irrigation authorities, and many thousands of acres of irrigated land have also been drained. But drainage, even more than irrigation, is a community problem and requires joint action. I known of many owners of irrigated land whose annual profits are low because of alkali injury to land once highly productive. Yet drainage is delayed year after year because of the "inertia" of some of the landowners.

Water-Right Controversies

The greater percentage of irrigated lands have but little if any value without water, and irrigation water is a mobile and a liquid asset. Most of the States have maintained and declared ownership in the water of all natural sources and have granted to individuals certain right to use the water for beneficial purposes. Those who provide for new diversions from streams, build new reservoirs, or drill new wells to get ground water frequently make, unintentionally, infringements on the rights of earlier water users, with the result that one of the problems peculiar to irrigation farming is almost continuous self-exertion to protect one's water right.

Some of the vigorous, self-reliant early irrigators settled their water-right disputes in the open fields and on the ditch banks with strong arms, shovels, and shotguns. The second and more peaceful, though very expensive, method is to litigate differences in the courts. Since the farmers themselves are seldom sufficiently informed concerning all of the facts needed by the courts, there has come a demand for agricultural engineers and agronomists to study irrigation requirements and present the facts in so-called "expert testimony." Because of the many variable factors involved, it is very difficult to find the whole truth concerning the facts on which water-right determinations are based. Therefore, many irrefutable contradictions have been made in the courts by lay witnesses and by specialists, so many indeed as to confuse the best of judges.

The more recent and by far the more sane, intelligent, and hopeful method of settling water-right controversies is by commissions and compacts. A notable instance of the use of this method is the supervision and coordination by the National Resources Committee of the work of several Federal Government bureaus in a thorough and comprehensive investigation looking to the permanent solution by compact of water-distribution problems in the Rio Grande Basin involving both interstate and international relations. Water-right controversies will no doubt continue to "come up" for many years.

Brief mention of a few other problems may be of interest. Water for irrigation purposes is considered by law as a use secondary to the use for culinary and domestic purposes. The growing populations of cities are demanding for culinary uses water formerly used for irrigation, giving rise to some perplexing problems in changes of use and water-right protection.

On some streams interstate water controversies are very difficult of solution. Trans-mountain water diversions could be ma[de] economically but are impeded by legal co[m]plications. In some localities vested pow[er] rights on the lower reaches of streams fo[rm] insurmountable barriers to the diversion [of] water upstream for use on the higher la[nd] needing irrigation.

In conclusion, it must be observed tha[t I] was assigned the task of talking about proble[ms] peculiar to irrigation farming. However, l[est] I leave an impression that these problems a[re] insurmountable and that the case for the irri[ga]tion farmer is hopeless, I must assure you th[at] beyond any doubt whatsoever, the privile[ges] peculiar to irrigation farming greatly outwei[gh] the problems.

The problems peculiar to irrigation farmi[ng] present a challenge to agricultural enginee[rs;] the privileges offer adventures in contentme[nt] to rural-minded people. Despite the numb[er] and the complexities of the problems pecul[iar] to irrigation farming, it is certainly a perm[a]nent, substantial, and sound branch of Ame[ri]can agriculture. The farmer who has cle[ar] title to good productive land and a vest[ed] right to ample water with which to irriga[te] his land, enjoys an economic security whi[ch] contributes to the making of the best elemen[t] in our democracy. This farmer never h[as] complete crop failures due to drought. T[he] year of drought is one in which he mu[st] irrigate more intelligently, and indeed mo[re] vigorously; and it may be one also in whi[ch] he will not trade in his last year's automobi[le,] but if he has, along with his good soil a[nd] good water supply, a reasonable amount [of] energy and good judgment he rarely h[as] delinquent taxes despite the adversities [of] the changing value of our money; and he [is] neither a case for the Resettlement Admin[is]tration nor an eligible for the Public Wo[rks] Administration.

Intimate acquaintance with the livi[ng] conditions on many irrigated farms leads me [to] conclude that our beloved agricultural en[gi]neer, the late Dr. Elwood Mead, was perfect[ly] right when he said, "It is a privilege to li[ve] on an irrigated farm."

CHART
of the United States Government

IN view of the interest in the chart of t[he] government of the United States, by libr[a]ries and educational institutions, which w[as] printed in the October issue of the Reclamati[on] Era, a reprint has been made on a little larg[er] scale.

The following nominal prices are quoted [to] those who may desire the chart in quantit[y] for educational or other purposes:

Quantity	*Price*	*Quantity*	*Pric[e]*
1,000	$1.50	250	$0.[…]
500	1.00	100	

THEODORE AUGUSTUS WALTERS

First Assistant Secretary of the Interior

1876–1937

EWS of the death of First Assistant Secre-
y of the Interior Theodore A. Walters, on
e morning of Saturday, November 27, 1937,
ne as a shock to the Interior Department
aff to whom he had endeared himself
roughout his rather brief term of service.
r. Walters left his desk one week prior to
s death. The seriousness of his indisposition
s not realized until word of his demise was
eived from the Naval Hospital, where he
d undergone an operation on Wednesday,
ovember 24.

Mr. Walters was appointed First Assistant
cretary of the Interior because of his
orough familiarity with the problems of the
est and as such he was assigned by Secretary
kes to direct grazing administration and
nd matters generally, including administra-
e matters pertaining to the Bureau of
clamation. Only a few weeks ago he made
extended inspection tour of the grazing
tricts of the West, covering 9,000 miles in
days.

Born in a two-room log house on a farm 40
les from Dubuque, Iowa, in 1876, Mr.
alters received his education in the public
ools and the upper Iowa University at
yette, putting himself through this univer-
y and the law school of the University of
wa by teaching. At the age of 29 years
r. Walters entered the practice of law at
ldwell, Idaho, where he remained until
s appointment to the position of First
sistant Secretary of Interior in 1933. Mr.
alters had been active in Democratic politics
his State and was elected attorney general
Idaho in 1916. In 1914 he was appointed
member of the State board of education to
ich he was reappointed in 1931, becoming
esident of the board in 1933.

Funeral services were held in Washington
November 29 and burial was made in
ldwell, Idaho, where Masonic services were
ld. Flags of the Interior Department

buildings will remain at half staff for 30 days, and as a further mark of respect to the late First Assistant Secretary the Department was closed from 10 a. m. to 1 p. m. on the day of the funeral.

Another tribute was paid to the memory of Mr. Walters on November 29 at the first meeting of a National Grazing Conference held in the Interior Department building and attended by cattle and sheep raisers from the 49 grazing districts. With delegates standing in silent tribute led by Assistant Secretary Oscar L. Chapman, resolutions were presented by members from Idaho, Mr. Walter's home state. The resolution follows:

"We, the delegates of the Taylor Grazing Districts Nos. 1, 2, 3, and 4, representing the livestock industry of the State of Idaho, en-route to Washington, received the sad news of the death of First Assistant Secretary Honorable Theodore A. Walters, and the untimely loss to his family, our Nation and the State.

"The livestock men of the Western States sincerely appreciate the untiring efforts of our friend and neighbor in his endeavors to set up and perfect the administration of the Taylor Grazing Act."

The delegates then selected a committee, composed of one representative from each of the 10 grazing States, to attend the funeral services. The committee was composed of the following: E. L. Jamieson, Arizona; James I. Wagy, California; W. S. Whinnery, Colorado; Merle L. Drake, Idaho; James C. Miller, Montana; Oliver Lee, New Mexico; Phil M. Tobin, Nevada; D. H. Adams, Utah; Anthony Stratton, Wyoming; and J. N. Jones, Oregon.

The active pall bearers were: Senator Jas. T. Pope, Boise, Idaho; Under Secretary of the Interior Charles West; Representative D. Worth Clark, Pocatello, Idaho; Representative Compton I. White, Clarksfork, Idaho; Addison T. Smith, former Representative from Idaho; and Oscar L. Chapman, Assistant Secretary of the Interior.

The honorary pall bearers were: Senator William E. Borah, Boise, Idaho; E. K. Burlew, Administrative Assistant to the Secretary, Department of the Interior; Harry Slattery, Personal Assistant to the Secretary, Department of the Interior; Roscoe Fertich, Commissioner, War Minerals Relief Commission; Frank Keenan, Chief of Drainage Levee and Irrigation Division, Reconstruction Finance Corporation; Representative Paul Greever, Cody, Wyo.; Dr. W. C. Mendenhall, Director, Geological Survey; Fred W. Johnson, Commissioner of the General Land Office; Arno B. Cammerer, Director, National Park Service; Dr. John W. Finch, Director, Bureau of Mines; John C. Page, Commissioner of Reclamation; and F. R. Carpenter, Director, Division of Grazing.

TRIBUTE BY SECRETARY ICKES

CRETARY ICKES, when informed of
r. Walters' death made the following state-
ent:

"Theodore A. Walters was a fine public
rvant—devoted, sincere and loyal to the
ople whom he served. As First Assistant
cretary of the Department of the Interior
ad come to rely greatly upon him. He was
lling to shoulder responsibility, he was a
an of sound judgment, and he never complained, however great the burden that he was called upon to carry.

"As a citizen of Idaho, he was particularly interested in the development of the West, which he knew so well. One of the greatest services that he has performed has been in connection with formulating and helping to carry out the new grazing control program. Only 2 weeks ago he returned to Washington after a 9,000-mile trip through the grazing States in the interest of the conservation of the public range. On this trip he addressed many gatherings of stockmen and sheepmen. He understood their problems and they understood his language.

"The death of Mr. Walters is a personal loss to me and a serious one to the Department. All of those who have worked with him will miss him."

Reclamation Organization Activities and Project Visitors

John C. Page, Commissioner of Reclamation, left Washington on December 2, for the West on matters pertaining to the work of the Bureau. En route he stopped at Urbana, Ill., on December 3 and addressed the University of Illinois Chapter of the American Society of Civil Engineers on the work of the Bureau of Reclamation, illustrating his address with lantern slides. The Commissioner's itinerary includes a visit to Spokane for a conference looking toward the formation of the Columbia Basin Irrigation District organization and the opening of bids on December 10 for construction of the high dam at Grand Coulee.

At Sacramento Mr. Page will confer on Central Valley matters, going from there to the Truckee Storage project at Reno and the Newlands project at Fallon, Nev. He will also attend the ceremonies at Boulder Dam and dedicate the plaque for labor.

During the Commissioner's absence, the Washington Office is in charge of Roy B. Williams, Assistant Commissioner.

Walker R. Young, construction engineer of Central Valley project, attended a meeting in Sacramento on October 21 of the Central California Coast-Southern California Coast Drainage Basin Committee of the National Resources Committee, and on October 27 he attended a regional meeting of the National Resources Committee at Los Angeles.

Miss Mae A. Schnurr, Chief of the Public Relations Division, delivered an address on December 2 at the Wilson Teachers College in Washington. The address on the subject The Story of Reclamation and the Work of the Bureau was illustrated with lantern slides.

Transfers

The following transfers were recently authorized by the Secretary of the Interior:

To Denver:

Oliver N. Parker assistant engineer from Boulder Canyon.

Oliver H. Milliken, junior engineer from Taylor Park.

Wm. P. Price, Jr., assistant engineer, from Taylor Park.

Rex P. Blackwell, assistant engineer, from Taylor Park (vice Wm. Killmore, transferred).

David O. Ehrenberg, junior engineer, from Taylor Park (vice John C. King, resigned).

Curtis L. Tyler, junior engineer, from Taylor Park (vice Carl R. Hamilton).

Harold W. Brewer, junior engineer, from Fort Collins, Colo.

To Central Valley:

Hyrum L. Empey, engineering draftsman, from Denver.

To Central Valley (Friant Division):

William J. McCrystle, assistant engineer, from Denver.

To Central Valley (Kennett Division):

Smith A. Ketchum, assistant engineer, from Riverton.

To Buffalo Rapids:

Edwin M. Bean, Chief Clerk, from senior clerk, Kendrick project.

To Los Angeles:

Gilbert L. Yetter, engineer, from Denver.

To Milk River (Fresno Dam):

Frank T. Cummings, chief of field party, from Sun River project.

To Parker Dam:

Stanley J. Bohman, junior engineer, from inspector, Boulder Canyon. Wm. Lee Davis, Jr., junior engineer, from Denver.

To Riverton:

Samuel T. Larsen, assistant engineer, from Denver.

Resignations

The following resignations have been accepted by the Secretary of the Interior:

Washington Office:

Sherwood E. Collins, Jr., engineering aide, C. C. C. Division, to accept employment with the Aluminum Co. of America.

Denver Office:

Geo. W. Carter, junior engineer, to accept employment as fuel research engineer with the Utah Conservation & Research Foundation, Salt Lake City, Utah.

Frank J. Van Horn, junior engineer, to accept employment with the General Motors Corporation at Lockport, N. Y.

Walter F. Dumke, assistant chemist, to accept position on the faculty of the Colorado State School of Mines.

Virgil F. Wetmore, senior engineering dra[ft]sman, to accept civil service position w[ith] the Railroad Retirement Board, Washi[ng]ton, D. C.

William H. Jurney, junior engineer, to go [with] Colorado State School of Mines (on facul[ty]).

Morris B. Espenscheid, assistant engin[eer], to go with the New York State Pu[blic] Health Commission.

Don E. Provost, assistant engineering dra[ftsman] man to go with a manufacturing conc[ern] in Denver.

Boulder Canyon:

Wallace B. Evans, associate engineer, [to] return to private industry.

Central Valley (Kennett Division):

Robert L. Gamer, inspector, to accept tea[ch]ing fellowship on staff of University [of] California.

New MAPS Available

The Bureau of Reclamation has iss[ued] three maps which may be obtained upon [ap]plication to the Bureau, payment, where [re]quired, to be made in advance by check [or] money order drawn to the Bureau of Re[cla]mation. The maps are as follows:

Map No. 24399A (1937), "Colorado Ri[ver] Basin below Boulder Dam" (black and whi[te]), size 8 by 10 inches. Free.

Map No. 26380 (1937), "Colorado Ri[ver] Basin" (black and white). Free.

Map No. 26376 (1937), "Yakima Proj[ect], Washington" (black and white), size 10½ [by] 16½ inches. Price 10 cents each.

Grazing Conference He[ld] in Washington

A CONFERENCE was held in Washing[ton] of members of district advisory boards [of] grazing districts November 29 to Decembe[r] inclusive, with 100 persons in attenda[nce] representing 2 or more members from e[ach] board.

An interesting program of activities for [the] 3 days was outlined with Assistant Secret[ary] Oscar L. Chapman as presiding officer. [He] read an address by Secretary Ickes, and [the] heads of the various agencies in the Dep[art]ment of the Interior were introduced.

Policy affecting grazing operations [and] approval of a new set of rules to be pla[ced] in operation as soon as possible were on [the] calendar of business.

Senator Ashurst and Party Visit Bartlett Dam

ght to left: Senator Henry F. Ashurst of Arizona; E. C. Koppen, Construction ıgineer, Bureau of Reclamation; H. J. Lawson, Chief Engineer and Lin B. Orme, president of the Salt River Valley Water Users' Association.

IMMEDIATELY upon returning to his home State, after a long, arduous congressional session as Chairman of the Committee on the Judiciary, Senator Henry F. Ashurst, Senior Senator from Arizona, made it a special point to visit the construction now in progress on the Bartlett Dam on the Verde River. The Senator was accompanied by officials of the Water Users' Association and the Bureau.

Senator Ashurst has been keenly interested in the program of reclamation and irrigation throughout the West, but especially in his home State. He holds to the conviction that the Nation should be concerned about increasing the productivity of the lands now being farmed, and points out that in the West we should be concerned in extending the area of irrigated lands to the maximum capacity of our streams and rivers. Forty acres of good irrigated land in the West will support a family in comfort; further east it will require a much larger area.

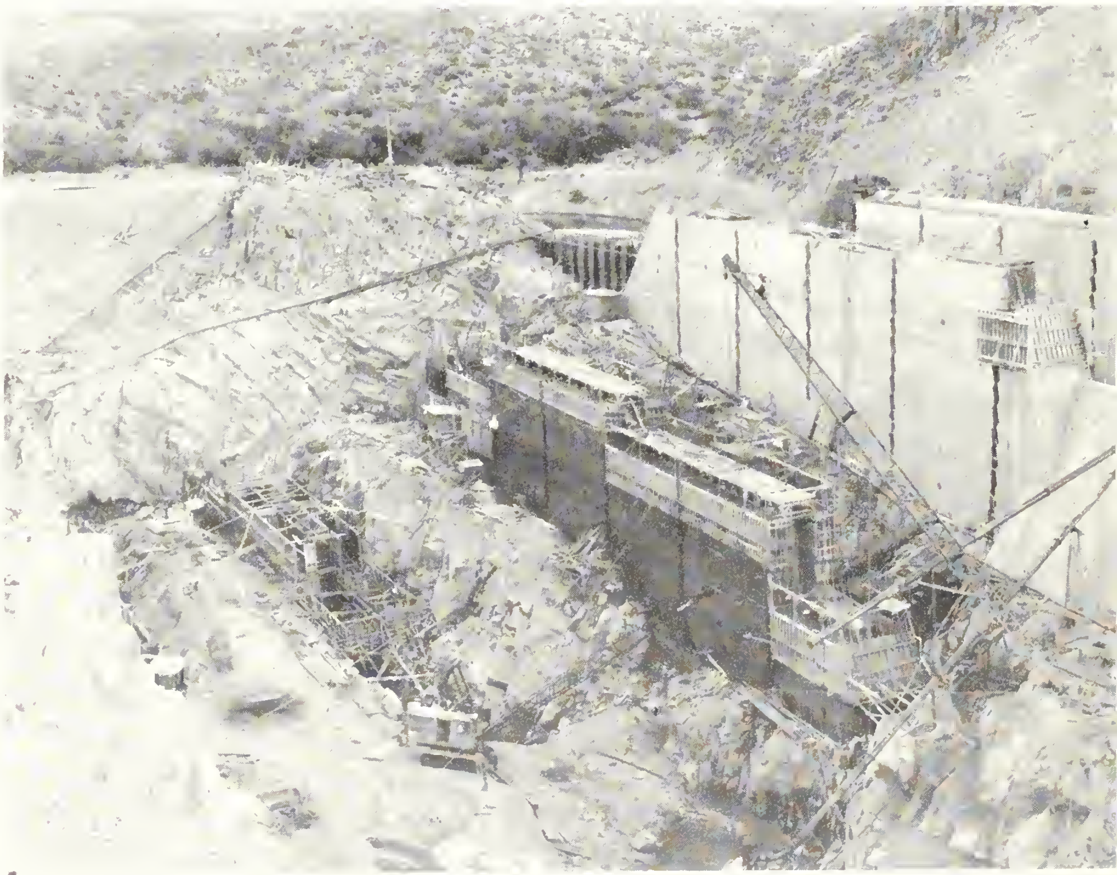
ISHING

in Mead Lake

WENTY-FIVE thousand rainbow trout fingerıgs were planted recently in the Colorado ver below Boulder Dam. An additional ıpment of 50,000 is expected later this fall.

Fishing for bass in Lake Mead is becoming popular pastime of the area. All fishing is ing done on the Arizona side because the evada season closes in September. Acrding to press reports, one group of three om Boulder City caught 35 pounds of bass an afternoon of fishing, with the largest h weighing $4\frac{3}{4}$ pounds. The largest bass ught in the lake prior to November 1 eighed, according to reports, $6\frac{1}{2}$ pounds.

The newspaper report states the most likely igin of the fish comes from old settlers in e Virgin River Basin, who state that in 04 a group of Missouri settlers in the valley anted approximately 100,000 bass in the ver and that these are the parents of the g ones in the lake today. A quantity of all bass were planted in the lake 2 years o, but it is doubtful if those have grown to e size of the local catches.



View looking upstream and towards left abutment showing progress on buttresses 6 and 7. Two sections of steel forms on buttress 7 are at elevation 1,610.

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Federal Irrigation Congress favors repayment program

THE FEDERAL IRRIGATION CONGRESS in session at Caldwell, Idaho, on September 15 passed a resolution extending to the Commission recently set up to study the repayment system of the Bureau of Reclamation—"our most hearty support and cooperation to the end that a program and legislation may be recommended that will make possible a more flexible policy of construction repayment in the future, a policy that will permit fluctuations in the amount of the annual construction repayments of the various projects based upon the exigencies of the times and the ability of the projects and the settlers thereon to pay from their earnings from project lands; and that said commission be requested to visit all projects where the water users wish their presence."

Commissioner Page addressed the congress on the relationship between the Bureau of Reclamation and its water users and stressed that "repudiation of repayment contracts by water users would be fatal, and continued agitation for moratoria in instances where they are not clearly justified would be a staggering blow."

The congress urged a change in present governmental statutes which it said give the Secretary of the Interior authority to change lands from nonpaying classes to pa[illegible] classes, but which do not permit him to cha[illegible] paying class lands to the nonpaying clas[illegible]

"Some lands were wrongfully classifie[illegible] the congress said in a resolution, "and m[illegible] lands due to seepage, erosion and other cau[illegible] are now barren and unproductive that [illegible] once productive.

"Such lands are becoming a burden u[illegible] the settlers of the projects who are carry[illegible] the financial load of their projects, and s[illegible] lands should be at least temporarily relie[illegible] of the payment of construction and o[illegible] charges."

• SUGAR FACTORY •

FORMAL dedication of the new beet su[illegible] factory of the Utah-Idaho Sugar Co. [illegible] Toppenish, Wash., was held on October [illegible] A special train brought leaders and offic[illegible] of the company from Utah, including [illegible] Heber Grant, president of the compa[illegible] and former United States Senator [illegible] Smoot, a director. The dedication banq[illegible] was attended by many prominent offic[illegible] About 200 business men from Yakima [illegible] present.

U S GOVERNMENT PRINTING OFFICE

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

———— ————, FIRST ASSISTANT SECRETARY, in charge of reclamation

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Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal [1]	Yuma, Ariz.	Leo J. Foster	Constr. engr.	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam and power plant [1]	Boulder City, Nev.	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Buffalo Rapids	Glendive, Mont.	Paul A. Jones	do	Edwin M. Bean	W. J. Burke	Billings, Mont.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. Devries	El Paso, Tex.
Alamogordo Dam	Fort Sumner, N. Mex.	Wilfred W. Baker	Constr. engr.		do	Do.
Central Valley	Sacramento, Calif.	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River	Austin, Tex.	H. P. Bunger	do	William F. Sha	H. J. S. Devries	El Paso, Tex.
Columbia Basin	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Gila	Yuma, Ariz.	Leo J. Foster	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah
Humboldt	Lovelock, Nev.	Stanley R. Marean	Resident eng. [2]	George B. Snow	do	Do.
Kendrick	Casper, Wyo.	H. W. Bashore	do	C. M. Voyen	W. J. Burke	Billings, Mont.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Fresno Dam	Havre, Mont.	H. V. Hubbell	Constr. engr.	do	do	Do.
Minidoka	Burley, Idaho	Dana Templin	Superintendent	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do	George W. Lyle	R. J. Coffey	Los Angeles, Calif.
Pine River	Bayfield, Colo.	Charles A. Burns	do	John S. Martin	J. R. Alexander	Salt Lake City, Utah
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do	Do.
Rio Grande	El Paso, Tex.	L. R. Fiock	Superintendent	H. H. Berryhill	H. J. S. Devries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	S. F. Crecelius	Constr. engr.	do	do	Do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Bull Lake Dam	do	Arthur P. Smyth	Resident engr.		do	Do.
Salt River	Phoenix, Ariz.	E. C. Koppen	Constr. engr.	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
Shoshone	Powell, Wyo.	L. J. Windle [2]	Superintendent	L. J. Windle [2]	W. J. Burke	Billings, Mont.
Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do	do	Do.
Sun River, Greenfields division	Fairfield, Mont.	A. W. Walker	Superintendent		do	Do.
Truckee River Storage	Reno, Nev.	Charles S. Hale	Constr. engr. [2]	George B. Snow	J. R. Alexander	Salt Lake City, Utah
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do	do	Do.
Upper Snake River Storage [3]	Ashton, Idaho	H. A. Parker	do	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash.	J. S. Moore	do	Philo M. Wheeler	do	Do.
Roza division	do	Charles E. Crownover	Constr. engr.	Alex S. Harker	do	Do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

1 Boulder Canyon. 2 Acting. 3 Island Park and Grassy Lake Dams.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division) [1]	Lower Powder River irrigation district	Baker, Oreg.	A. J. Ritter	President	J. A. Phillips	Keating
Bitter Root [4]	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton
Boise [1]	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	J. J. Hanagan	Boise.
Do.	Black Canyon irrigation district	Notus, Idaho	W. H. Jordan	Superintendent	L. M. Watson	Caldwell.
Frenchtown	Frenchtown irrigation district	Frenchtown, Mont.			Ralph P. Scheffer	Huson
Grand Valley, Orchard Mesa [3]	Orchard Mesa irrigation district	Grand Jctn., Colo.	C. W. Tharp	Superintendent	C. J. McCormich	Grand Jctn.
Huntley [4]	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine
Hyrum [3]	South Cache W. U. A.	Hyrum, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley [1]	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza
Klamath, Horsefly [1]	Horsefly irrigation district	do	Henry Schnor, Jr.	President	Dorothy Eyers	Do.
Lower Yellowstone [4]	Board of Control	Sidney, Mont.	Axel Persson	Manager	Axel Persson	Sidney.
Milk River: Chinook division [4]	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
Minidoka: Gravity [1]	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	O. W. Paul	Rupert.
Pumping [1]	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding [1]	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands [3]	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate division [4]	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie division [4]	Gering-Fort Laramie irrigation district	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering
Do. [4]	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do	Mary E. Harrach	Torrington.
Northport division [4]	Northport irrigation district	Northport, Nebr.	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan [1]	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.) [3]	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do	D. D. Harris	Layton.
Salt River [2]	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland division [4]	Shoshone irrigation district	Powell, Wyo.	M. P. McLaughlin	Irri. superintendent	Geo. W. Atkins	Powell.
Frannie division [4]	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Superintendent	Lee N. Richards	Deaver.
Strawberry Valley [3]	Strawberry Water Users' Assn.	Payson, Utah	S. W. Grotegut	Manager	E. G. Breeze	Payson.
Sun River: Fort Shaw division [4]	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	do	E. J. Gregory	Fort Shaw.
Greenfields division [4]	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East division [1]	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West division [1]	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon
Uncompahgre [3]	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting superintendent	J. Frank Anderson	Montrose
Yakima, Kittitas division [1]	Kittitas reclamation district	Ellensburg, Wash.	V. W. Russell	Manager	G. L. Sterling	Ellensburg

1 B. E. Stoutemyer, district counsel, Portland, Oreg.
2 R. J. Coffey, district counsel, Los Angeles, Calif.
3 J. R. Alexander, district counsel, Salt Lake City, Utah.
4 W. J. Burke, district counsel, Billings, Mont.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Colorado-Big Thompson		Mills E. Bunger	Engineer.
Boise-Weiser-Payette	Boise, Idaho	Lester C. Walker	Do.
Buford-Trenton	Denver, Colo.	Wm. G. Sloan	Do.
Kings River-Pine Flat	Fresno, Calif.	John R. Iakisch	Constr. engineer.
Western Slope (Colo.)	do	Frank C. Merriell	Engineer.
Black Hills	do	R. E. Kennedy	Assistant engineer.
Eastern Slope (Colo.)	do	A. N. Thompson	Engineer.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	Do.
Grande Ronde	La Grande, Oreg.	C. C. Fisher	Do.

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